Rock Products
With which is Incorporated CEMENT and ENGINEERING NEWS
Founded 1896

Volume XXXV Chicago, November 5, 1932 Number 22

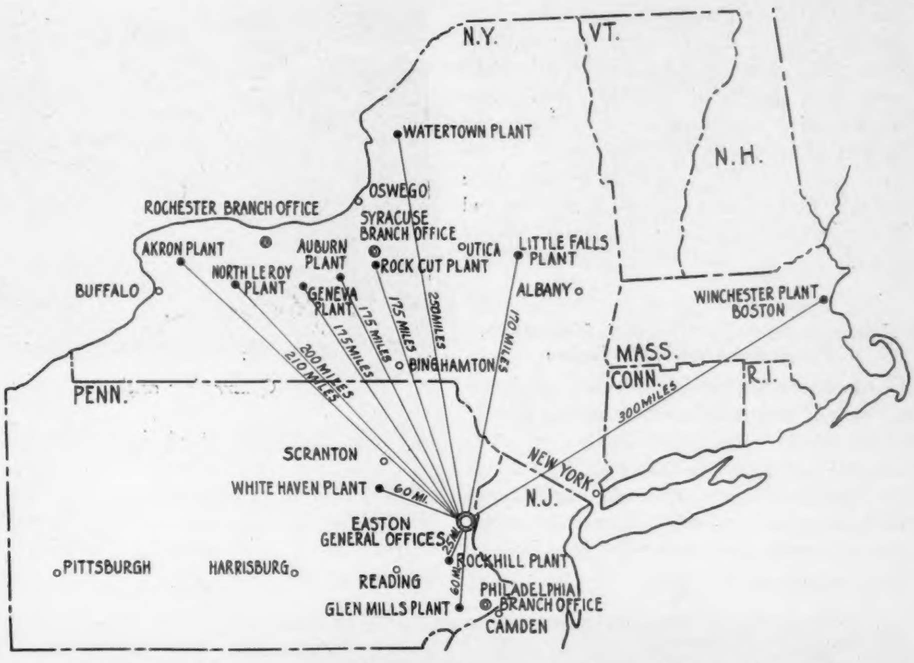
Centralized Control of Widely Distributed Crushed Stone Plants

Operations of the General Crushed Stone Co., Easton, Penn.

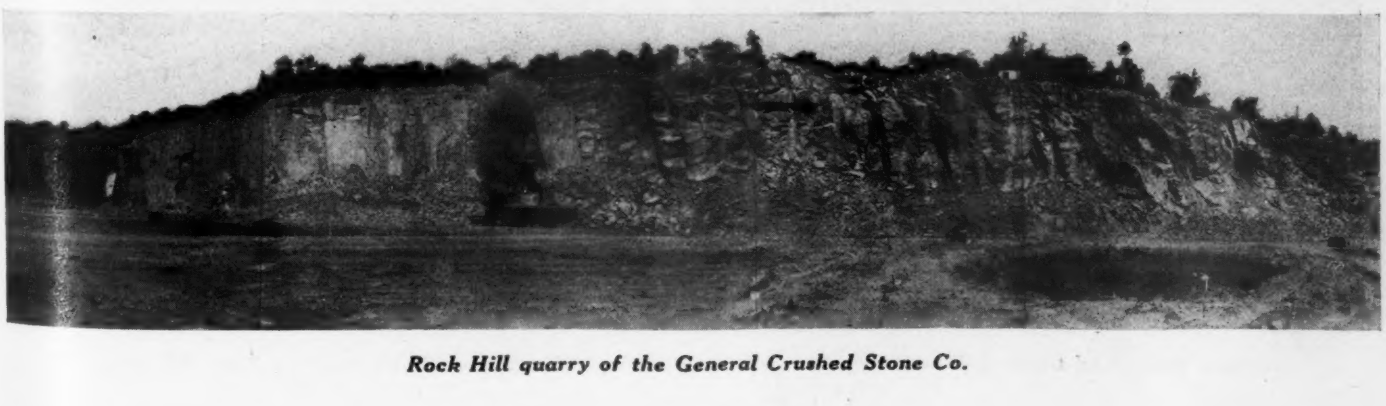
By Earl C. Harsh
Associate Editor, Rock Products

ALTHOUGH the officers of the General Crushed Stone Co. are well known to the industry because of the prominent part they have taken for many years in the activities of the National Crushed Stone Association, the plants of this company are perhaps not as well known. Articles have appeared in Rock Products at various times regarding some of the individual plants now operated by the company, but nothing covering its operations as a whole, so that the present article may be of interest to many producers.

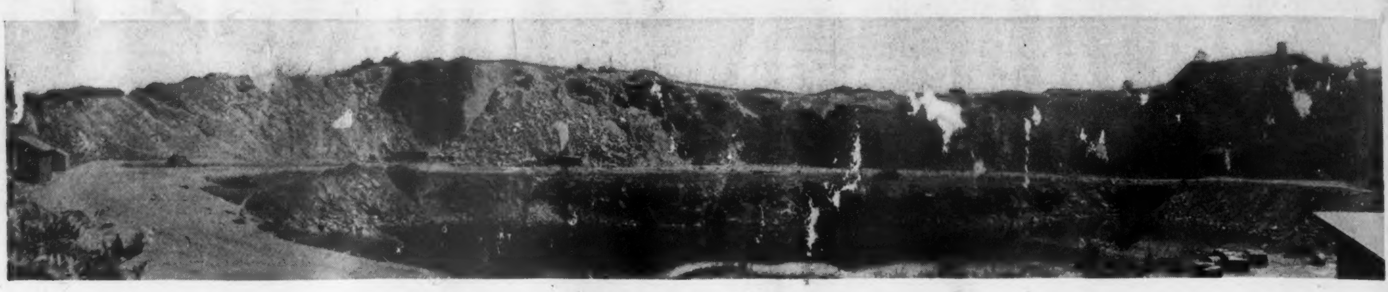
The company was formed in 1899 and incorporated in 1900, starting with a few plants and gradually increasing the number and the territory served until now the operations extend over a considerable area and have normally a combined output of some 3,000,000 tons annually. Several of the older plants have been abandoned (Wilkes-Barre and Port Deposit within the past year), but at the present time 11 crushed stone plants and two sand and gravel plants are being operated.



Locations of various offices and plants of the General Crushed Stone Co.



Rock Hill quarry of the General Crushed Stone Co.



Glen Mills quarry of the General Crushed Stone Co.

Seven of the stone plants are in New York state, three in Pennsylvania and one in Massachusetts. The location, capacity and kind of material produced at each of these plants is shown in the accompanying table. The sand and gravel plants are located at Palmer (Fayettesville), N. Y., and Lacona, N. Y., both in the general vicinity of Syracuse. These plants each have a capacity of about 1000 tons per day.

In addition, the company operates six Amiesite plants, located at Rock Hill, Glen Mills and White Haven, Penn., and Akron, Little Falls and North LeRoy, N. Y., and has a black top plant at Winchester, Mass.

Of the present plants, Rock Hill and North LeRoy have been operated longest. The Glen Mills plant was acquired in 1906 and the White Haven plant was built in 1913. The plants at Akron and Little Falls were both purchased in 1915. The Winchester plant was acquired in 1919 and the Geneva plant in 1925. Then, in 1928, the Rock Cut Stone Co., operating crushed stone plants at Rock Cut (Syracuse), Auburn and Watertown and two sand and gravel plants, was merged with the General Crushed Stone Co.

PLANTS OF GENERAL CRUSHED STONE CO.

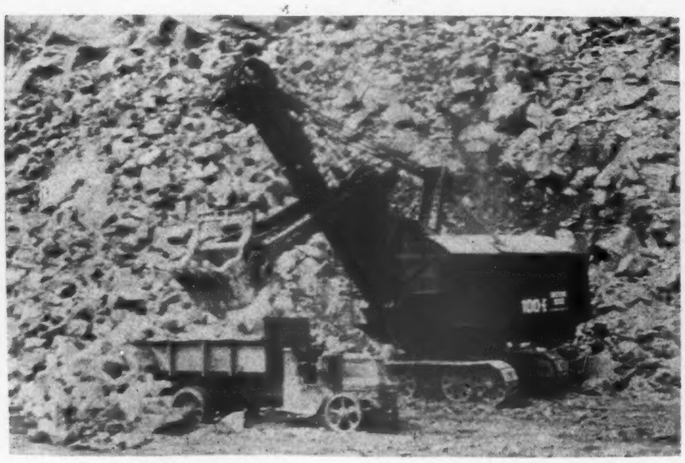
Plant and address	Material produced	Daily capacity tons
Akron, Akron, N. Y.	Limestone	4000
North LeRoy, LeRoy, N. Y.	Limestone	3500
Geneva, Oaks Corners, N. Y.	Limestone	2000
Auburn, Auburn, N. Y.	Limestone	1800
Rock Cut, Syracuse, N. Y.	Limestone	3000
Watertown, Watertown, N. Y.	Limestone	1500
Little Falls, Little Falls, N. Y.	Syenite	1500
Winchester, Winchester, Mass.	Trap rock	2000
White Haven, White Haven, Penn.	Sandstone	1200
Rock Hill, Quakertown, Penn.	Trap rock	1500
Glen Mills, Glen Mills, Penn.	Trap rock	1500
		23,500

Quarrying and stripping methods at the Auburn plant

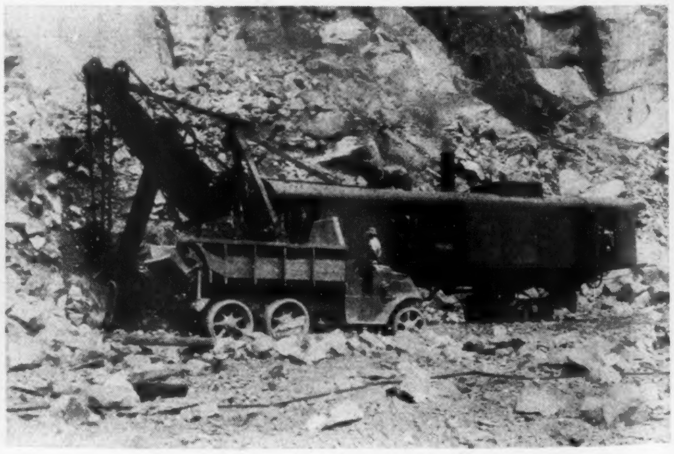
Products Include Crushed Limestone, Trap Rock and Sandstone

Crushed limestone is produced at six of the plants, trap rock at four and sandstone at one plant. The plant details vary considerably, as would be expected, because of the difference in the materials handled and the local conditions and because the plants were all, except one, purchased from others. However, numerous changes have been made and new equipment added for better efficiency and to meet the more exacting specifications now in force, so that after all there is a considerable uniformity of method. This is particularly noticeable in the general adoption of vibrating screens for sizing and in the use of motor trucks for quarry transportation wherever feasible.

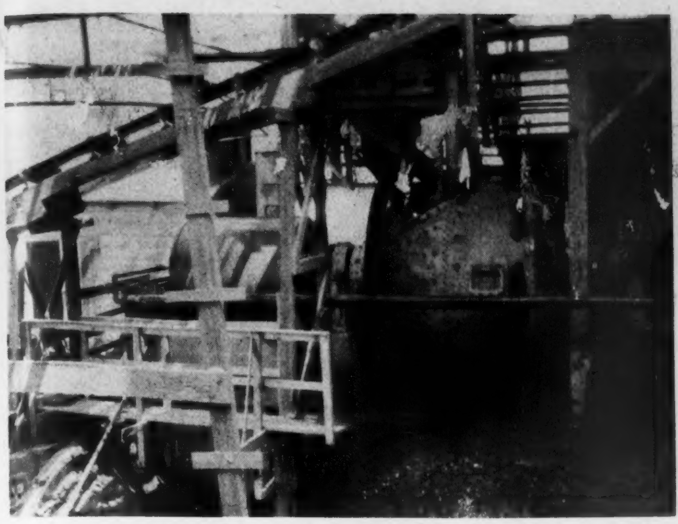
The company was one of the pioneers in the use of trucks in the quarry and is now using this form of transportation in five of the quarries. The sizing of the stone is now

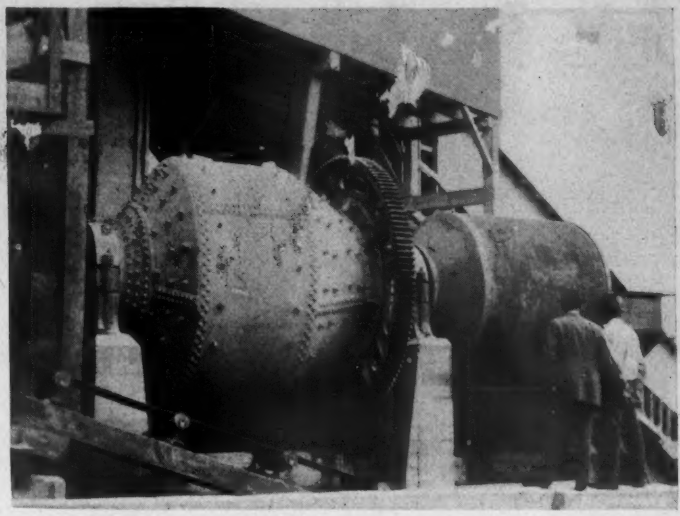


Electric shovel and truck at Glen Mills quarry



Steam shovel and truck at Rock Hill quarry





One of the scrubbers at the Rock Cut plant and, at right, the scrubber at the Auburn plant

done entirely with vibrating screens at eight of the 11 plants and in part at the other three. A total of 64 vibrating screens are used, with four revolving screens at one plant and one each at two other plants.

Changes have been made during the past winter so that stone can be washed at four plants. At Rock Cut two Hardinge scrubbers (an 8-ft. and a 4-ft.) and at Auburn an 8-ft. Hardinge scrubber have been installed. A separate washing plant with vibrating screens has been constructed during the present year at the North LeRoy plant, and at Geneva the stone is washed over screens at the loading point.

The company has not hesitated to install new and improved equipment as soon as its value has been demonstrated and, in some cases, before its use by others.

Quarrying Methods

The amount of stripping to be removed varies from a few feet up to a maximum of 27 ft. at Glen Mills. This quarry and that at Rock Hill present the most difficult stripping propositions. Small shovels and cranes are generally used and the material is hauled away in trucks. Light trucks such as the Ford 1½-yd. size have been found to be generally more satisfactory for this work than heavier ones. At Akron, where the overburden is 4 to 6 ft. deep, a 1½-yd. 36 Marion steam shovel is used for stripping. At Auburn a 1¼-yd. 31 Marion steam shovel is used. A 36 Marion steam shovel is also used at Rock Hill. No. 21 Marion steam shovels are used at White Haven and Glen Mills and a Marion gas-electric at Rock Cut. A Marion crane is used at Geneva and a Thew electric shovel at Watertown.

Until recently all blasting was done by means of 6-in. well drill holes, but tunnel blasting has now been adopted at Rock Hill and White Haven. This has proven more satisfactory at these operations than the other method and it may also be adopted later at Glen Mills. The hard, tough trap rock at Rock Hill, Glen Mills and Little Falls makes drilling slow and difficult so that only 5 to 10 ft. of hole can be drilled per day. The trap rock at the Winchester quarry is also hard to drill, but tunnel blasting has not been adopted there because of the nearness of the plant to the town.

Set of steel pins used to show intensity of vibrations from quarry blasting

Research on Blasting Vibration

Some years ago damage suits were brought against the company because of the quarry blasting at this plant, and in order to get at the facts the company carried on some research work to determine the mag-

White Haven quarry of the General Crushed Stone Co.

Winchester quarry of the General Crushed Stone Co.

nitude and extent of the vibrations caused by blasting. The results of this work have been of considerable benefit to the industry generally since they demonstrated that such vibrations are not nearly as severe or as damaging to structures as some had been led to believe. This work was described in ROCK PRODUCTS March 10, 1923, July 10, 1926, and February 5, 1927.

The method used for determining the amount of the vibration consisted in placing sets of small steel pins of various lengths upright on a level surface and noting how many were overturned by the blast. Several sets were placed at different distances from the blast. Each set consisted of eight perfectly straight pins each 1/4 in. in diameter with square, true ends and ranging from 4 in. to 15 in. in length.

These were set on end in a vertical position on a smooth level surface so that any vibration would tend to overturn them, the long pins, of course, being first to fall. It was found that the number of pins which would fall varied inversely with the distance from the blast; also, that all of the pins never fell, and that none of the pins in the set at the office 700 ft. from the blasts had ever fallen from blasting vibrations.

In this way it was possible to demonstrate to the layman or juror that if these delicately balanced pins did not fall, then the vibration was so small as to be negligible so far as it might cause damage to a building.

Drilling and Blasting

The height of the quarry face varies considerably at the different operations, that of the trap rock or hillside quarries being much more than the limestone quarries. At Rock Hill the height of the face is 125 to 200 ft.; at Glen Mills and Little Falls it is about 100 ft.; at Winchester it is about 120 ft., and at White Haven, 50 to 75 ft. At North LeRoy and at Geneva a face of about 60 ft. height is worked and at Rock Cut and Auburn about 30 ft. The Watertown quarry has a 35-ft. face and a 20-ft. ledge is worked at Akron.

Two drilling machines are used at most of the plants or a total of about 20 for all blast hole drilling. These are all electric motor driven and include Loomis, Cyclone and Keystone drills in the order named. Various dynamites of 40 to 60% strength are used at the limestone quarries and 60 to 75% dynamite at the trap rock quarries. Cordeau-Bickford fuse is used for firing the blasts.

Quarry Loading and Haulage

The rock is excavated and loaded by a total of 19 shovels according to the table following. Three of these are electric and the balance are steam operated, all being mounted on crawler treads except two, which are equipped with tractor wheels.

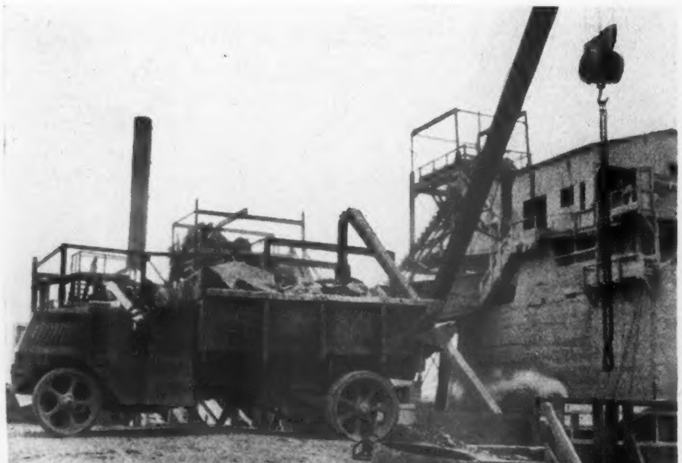
A total of 17 trucks are used at five plants for the transportation of the rock from the quarry to the crusher; three at Watertown, three at Rock Hill, three at White Haven, four at Glen Mills and four at Winchester.

These are practically all 7½-ton Mack trucks with solid tires and equipped with Easton end dump bodies with automatic drop doors. They haul loads up to a maximum of about 12 tons of rock. The length of haul varies from about 500 ft. at White Haven to about 1200 ft. at Glen Mills. Truck haulage has been in use for five or six years at some of the plants.

At six of the plants side dump cars and steam locomotives are used for quarry haulage. With the exception of the Little Falls plant, where cars each carrying two 7-yd. pans are used, the quarry cars are of 4- and 5-yd. capacity. These are in part the Koppel steel drop-door type and in part the lift-door contractors' type of wood and steel construction.

QUARRY LOADING EQUIPMENT

Akron	2—2½-yd. 92 Marion steam shovels.
North LeRoy	2—3-yd. 91 Marion steam shovels.
Geneva	2—2½-yd. 70 Bucyrus steam shovels.
Auburn	2—2-yd. 51 Marion steam shovels.
Rock Cut	2—3-yd. 78 Bucyrus steam shovels.
Watertown	2—1½-yd. 37 Marion electric shovels.
Little Falls	1—3-yd. 95 Bucyrus steam shovel.
Winchester	2—3-yd. 76 and 90 Marion steam shovels.
White Haven	1—2-yd. 51 Marion steam shovel.
	1—2½-yd. 70 Bucyrus steam shovel.
Rock Hill	1—3-yd. 100 Marion steam shovel.
Glen Mills	1—3-yd. 100B Bucyrus-Erie electric shovel.



Quarry truck ready for dumping and, at right, being loaded by steam shovel at White Haven plant

The cars are dumped at the crusher by either air hoists or motor driven cable hoists. At both the Geneva and North LeRoy plants a chain conveyor type of car haul in the center of the track is used to handle the cars past the crusher and return them to the empty track. At Geneva the car haul lowers the cars down a short incline to the empty track as shown in one of the illustrations. This arrangement saves one locomotive at each plant.

The rock is dumped direct to the primary crusher except that at the Winchester and Glen Mills plants the trucks are dumped to a short pan conveyor feeder which discharges to the crusher.

Except at the Akron plant, where a number of Lima "Shay" geared-type locomotives are used, three or four steam locomotives of the 18-ton size (10- by 16-in. cylinders) are normally used at each plant. These are principally Porter, Vulcan and Baldwin locomotives.

General view of North Le Roy plant

Sizing Done Mostly With Vibrating Screens and Washing Facilities Increased

The sizing of the stone is done almost entirely with vibrating screens. These range in size up to 6 by 12 ft. and are arranged as shown on the accompanying flow sheets and in the brief plant descriptions which follow.

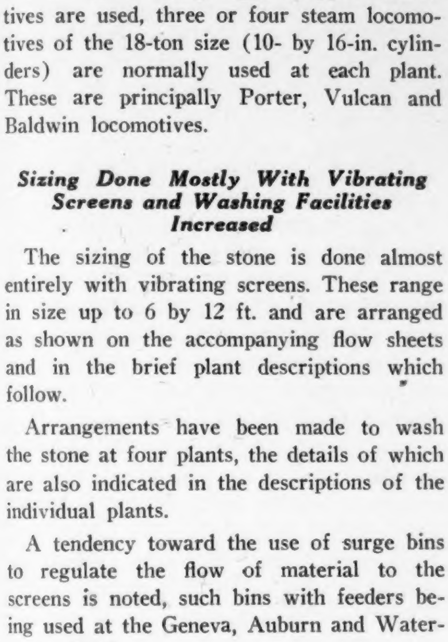
Arrangements have been made to wash the stone at four plants, the details of which are also indicated in the descriptions of the individual plants.

A tendency toward the use of surge bins to regulate the flow of material to the screens is noted, such bins with feeders being used at the Geneva, Auburn and Watertown plants.

Akron Plant

The Akron, N. Y., plant was formerly operated by the Kelley Island Lime and Transport Co., chiefly for the production of railroad ballast. It was purchased by the company in 1915 and was destroyed by fire and rebuilt in 1924. Side dump cars of 5-yd. capacity and 18-ton Lima Shay geared locomotives are used in the quarry. The rock is dumped to two No. 10 Allis-Chalmers gyratory crushers and the crushed material carried up by two bucket elevators to a battery of Niagara vibrating screens. From each elevator the material passes over two 5- by 10-ft. single deck screens in tandem.

Recrushing is done by two No. 6 gyratory crushers and a 4-ft. Symons cone crusher, the recrushed material being carried up by a separate bucket elevator to a 5- by 10-ft. single deck screen. An additional 5- by 8-ft. screen is used for final cleaning of the stone. A total of six vibrating screens are used. The plant is electrically operated on purchased power. J. D. Hawthorne is superintendent.



Flow sheet of North Le Roy plant

North LeRoy Plant

The North LeRoy plant was built originally in 1898 and has been operated by the company since 1902. Side dump cars of 4-yd. capacity and steam locomotives are used in the quarry. The rock is dumped to a 48- by 60-in. Traylor jaw crusher located in the quarry and the crushed material is carried by an inclined 48-in. pan conveyor to a rail grizzly and vibrating screen for the removal of the fines.

The fines which pass through the lower deck of the screen are carried to a waste pile by an inclined belt conveyor. A 4- by 6 ft. double deck Robins vibrating screen is used for this separation. The coarse material passing over the grizzly and screen falls to a hopper from which it is carried up into the plant by skips.

Balanced skip cars of 7-ton capacity, operated by a steam hoist on a double track incline, carry the material over the tracks of the Lehigh Valley railroad to a 24-in. gyratory crusher at the screening plant. Additional recrushing is done in one No. 8 and three No. 6 gyratory crushers.

All crushers discharge to a 48-in. bucket elevator which carries up to the first of a battery of eight double deck Niagara vibrating screens above the loading bins. The first screen is a 5- by 12-ft. followed in tandem by a 5- by 10-ft.

These screens scalp off the oversize and separate out the two larger sizes as indicated on the accompanying flow sheet, these being returned as desired to the recrushers. The throughs from both screens are elevated and conveyed to two parallel 5- by 10-ft. screens followed by two 4- by 8-ft. and two 4- by 10-ft. screens, where the other sizing is done.

During the past winter a 36-in. mixing belt conveyor was installed below the loading bins with a gravity screen at the end for cleaning the stone at the loading point.

A separate washing plant has been built adjacent to the main plant and consists of loading bins above a railroad track, with vibrating screens above for jet washing. It has a steel frame with timber sides and bottom for the bins. One 5- by 10-ft. double deck Niagara vibrating screen and one 3- by 8-ft. vibrating screen are used, fed by an inclined belt conveyor.

The main plant is partly steam driven and partly electric driven, using purchased power. The four crushers and the bucket elevator are driven by a 400-hp. steam engine, the jaw crusher by a 200-hp. General Electric slip ring motor and the other equipment by individual motors. A. L. Scott is manager and M. Bovee is superintendent.

(To be continued)

Plotting Sieve Tests of Aggregates

Part II—Single Scale and Triaxial Plots

By Edmund Shaw
Contributing Editor, Rock Products

Plots With a Single Scale

So far all the plots shown have been made using a vertical and a horizontal scale, which are rectangular coordinates. There are other methods of plotting sieve tests that have only one scale. While these are simpler, they have been treated in the second place because the aggregate industry is not so familiar with them as it is with the plots already described.

The plot shown in Fig. 10 is called by the textbooks the direct plot (non-cumulative) and it has been used by mining and metallurgical engineers for as long as they have plotted sieve tests. But it was not used in the aggregate industry until H. F. Kriege introduced it in the article "The Missing Link in Aggregates," published in ROCK PRODUCTS, June 21, 1930.

As in other plots, the vertical lines represent the sieves of a series, but the distances between them mean nothing and may be any convenient spacing. The scale on the left represents percentage by weight as in the other plots, but the percentages plotted on the sieve lines are not cumulative as with the other plots. They are just the percentage remaining on the individual sieves. The points are connected by a line so that they can be seen more clearly. If a standard vertical scale and horizontal spacing of the sieve lines is adopted, the shape made by the line connecting the points is characteristic of the grading and gradings may be readily compared with one another and with an ideal grading. The grading marked Fuller's curve in Fig. 10 is approximately the same grading as that plotted in Fig. 1.

The reason why Dr. Kriege adopted this plot for aggregate gradings was that it shows any excess or deficiency in a very striking way. The article referred to showed the danger of "gap" gradings and gradings having an excess of certain sizes. It is difficult to see these quickly in the ordinary cumulative plot, as a "gap" left by omitting one size entirely would merely make a flat place in the curve. But the sharp dip made by a gap on the direct plot catches the eye at once.

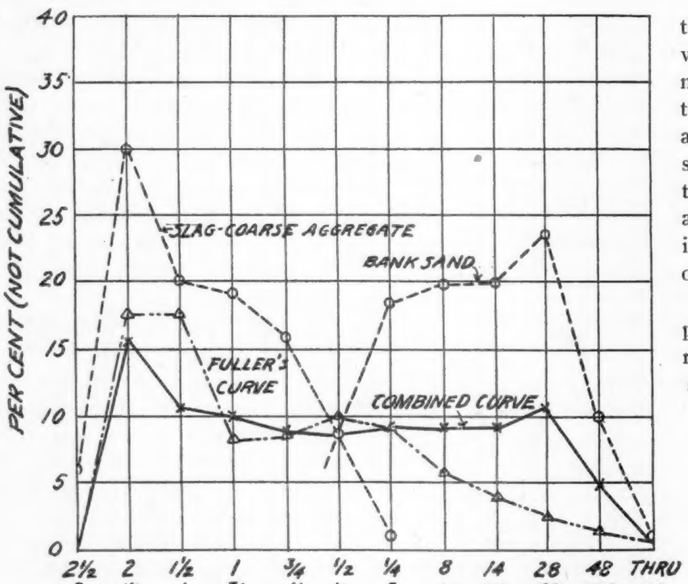


Fig. 10. Non-cumulative plot long used in the mining and metallurgical industries

This method of plotting also adapts itself very well to a graphical method of plotting mixtures of fine and coarse aggregate, as can be seen from a study of the curves of the fine and coarse aggregates in Fig. 10 and the curve of their combination.

Another method of plotting the percentages remaining on individual sieves, which has been used in the mining industry, is called Callow's method, from its inventor. This is illustrated in Fig. 11. The percentages remaining on the individual sieves are represented by blocks or lines, the height of a block corresponding to the percentage on a single sieve. One advantage of this is that more than the size can be readily shown, for example, the percentage of iron or copper contained in each size. Another advantage is that it takes very little space and a number of plots can be placed side by side for comparison.

In Fig. 12 is shown a single scale plot of a peculiar kind designed by H. S. Cortelyou, construction engineer, of Los Angeles, Calif. The center line of the polygon is the ideal or standard grading for the product and the percentages set off above or below this line show the variations from the ideal when the sieve test of a sample is thus plotted. This form of plot is so simple that it has proven to be easily understood by men not at all familiar with sieve tests and graphical methods.

The California State Highway Department uses a similar plot representing the ideal curve as a straight line. But it is a logarithmic scale distorted so as to bring the ideal straight and the writer prefers the simple form given here.

For plotting the grading of aggregates the direct plot, especially in the form adopted by Kriege, has very decided advantages. It emphasizes strongly those characteristics of the aggregate that determine its value. At the same time it does not show anything that the cumulative plot does not show, provided the plot is correctly made and is read as carefully as it should be. The writer

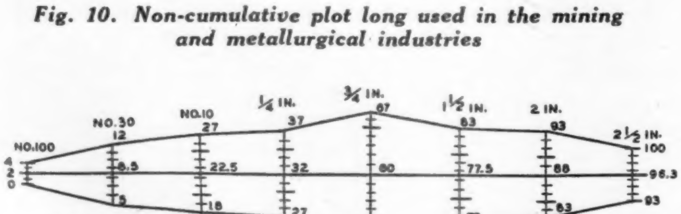


Fig. 12. Method of plotting which shows variations between actual grading and ideal or standard grading

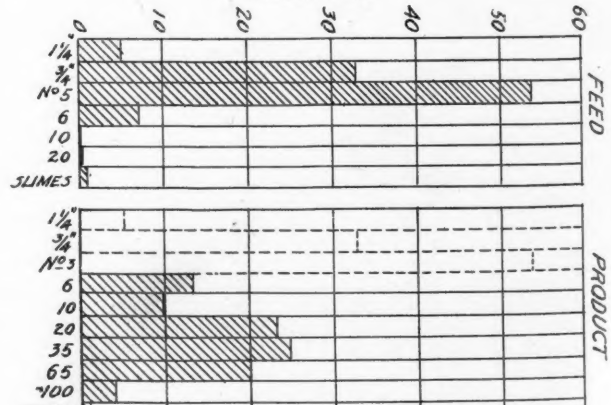


Fig. 11. Callow's method of plotting percentages remaining on sieves

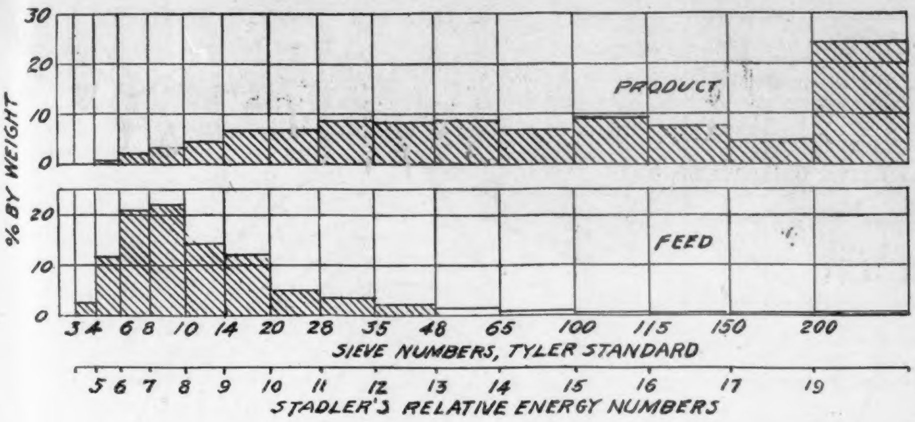


Fig. 13. Simple form of crushing diagram

prefers to see both where he is comparing the work of screens and classifiers. Either by itself may be misleading.

Area Plots

If the percentage on any sieve be multiplied by the percentage of silica, for example, the product may be represented by a rectangle. When this is done for each sieve used there will be a series of rectangles or blocks each varying in size according to the fraction remaining on the sieve and also according to the silica content of that fraction. Each block will represent that part of all the silica that is in one sieve size. Another set of blocks may be made for the lime content, for example, and still others for other contents. And these may be shown separately or combined in a single plot or graph, so that one easily sees the sizes richest or poorest in these elements. Such plots are commonly used in textbooks, magazines and newspapers. There is, however, a special case of this area plotting that belongs with a discussion of sieve analysis, and that is in crushing diagrams.

In all forms of the crushing diagram the percentage remaining on any sieve is shown on either the vertical or the horizontal scale and some number that represents the en..gy required to make this size is shown on the other scale. The product of the two is therefore a rect..gle.

The simplest form of a crushing plot is that shown in Fig. 13. This represents not the feed and product but the energy used to make the feed and the product, in this case from a ball mill. The vertical scales represent the percentages remaining on each sieve size and the horizontal scale represents the relative energy required to crush to that size. The plot shows in a striking manner how much of the energy is used in making the finer sizes of the product.

A crushing diagram that uses reciprocals of sieve sizes and is still quite manageable and almost a standard method of plotting is that of Gates. It is shown in Fig. 14. The

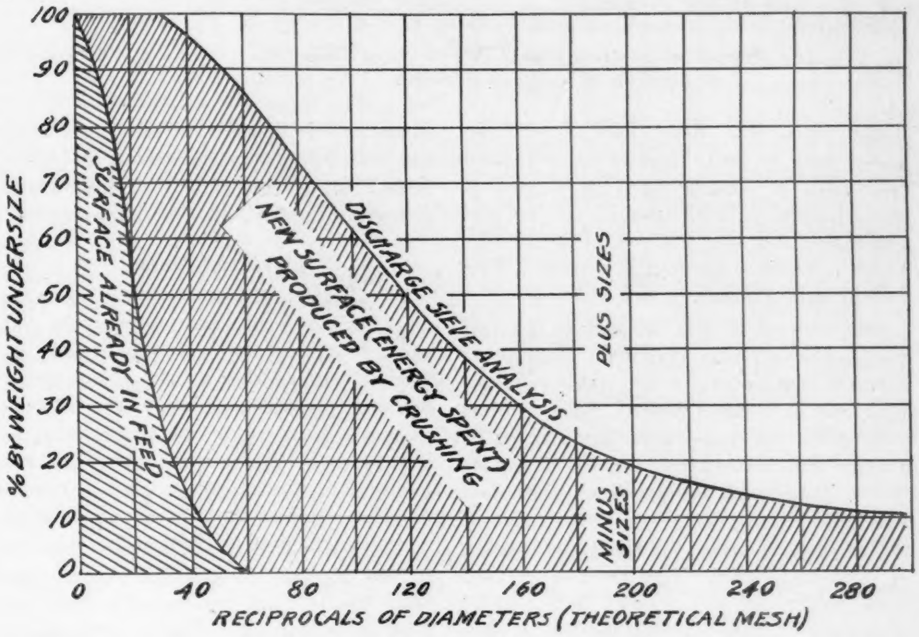


Fig. 14. Gates' surface crushing diagram

explanation in detail would be too long to include here but may be found in vol. 95, p. 1039, and vol. 97, p. 795 of the *Engineering and Mining Journal*. The method is shown to be applicable to the grinding of cement and the grading of aggregates. An explanation is also given in Taggert's Handbook of Ore Dressing, p. 495. Briefly, the areas shown represent the energy required to crush to the grading plotted. The small area represents the energy required to make the feed and the large one the energy to make the product. The difference between them is the actual energy expended in crushing. It is generally called Gates' crushing surface diagram and it is excellent for comparing the work of two crushing machines of the same kind.

Another method of plotting sieve products as areas is shown in Fig. 15. But in this case the shape and not the size of the area is important. The areas are all polygons and each is made by plotting the percentages remaining on each sieve to the right and to the left of a center line. This makes two

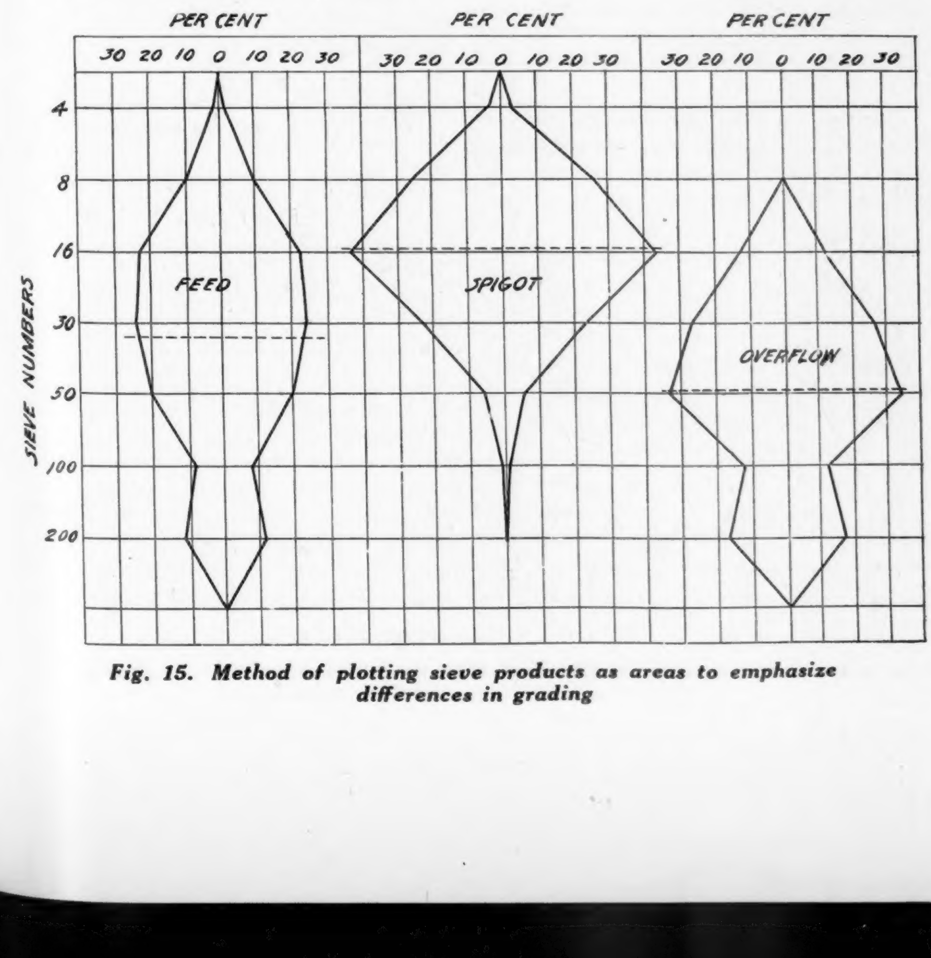


Fig. 15. Method of plotting sieve products as areas to emphasize differences in grading

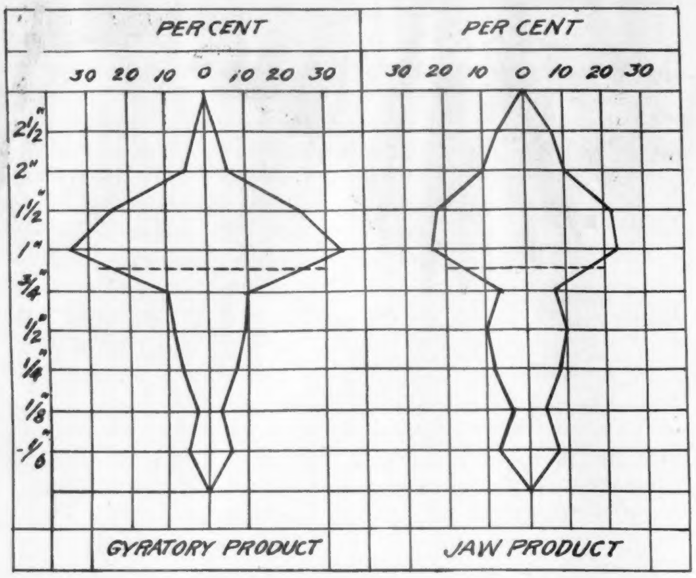


Fig. 16. Method of plotting sieve tests to show difference in grading of crushed product

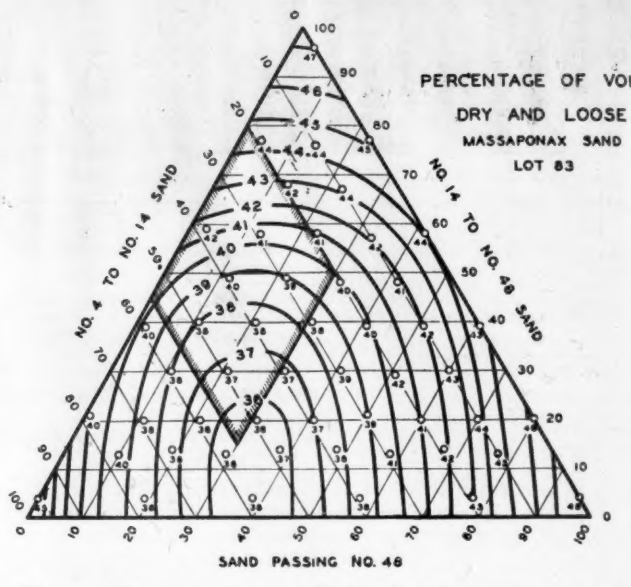


Fig. 18. Diagram showing different mixtures giving same percentages of voids

direct plots, like those used by Kriege, placed back to back. The effect is to show differences in grading in a most striking manner. Fig. 15 is the plot of the feed and the coarse and fine products of a classifier which is splitting the feed at a point a little coarser than 30 mesh.

The method is also adapted to plotting crushing tests, and is used in Fig. 16 to compare the product of a gyratory crusher with that of a jaw crusher. Both crushers were given the same feed, large lumps of granite, the idea being to see the difference in the grading of the products. The fact that the gyratory broke the greater part of the product to about the same size (1-in.) is strikingly shown. The jaw crusher used more power and this resulted in a greater proportion of fines. The method was devised by W. H. Coghill of the U. S. Bureau of Mines and is described in Technical Paper 456, "Classification and Tabling of Difficult Ores." It is valuable in that it shows differences in products in a striking manner.

Triaxial Plots

The triaxial plot is of great advantage where a number of gradings are to be compared to see how they vary in a single characteristic, or whether or not any particular grading falls within certain limits. A good example of the use of the triaxial diagram is to be found in the work of the National Sand and Gravel Association and the National Crushed Stone Association laboratories on the effect of grading on voids.

Two methods of triaxial plotting have been invented and unfortunately both systems are still in use. This is illustrated by Fig. 17. The points *a* and *b* both indicate a mixture of 23% fine, 43% medium and 34% coarse. For *a* this is shown by the perpendicular distances from the point to the sides designated, as is shown by the solid lines. For *b* it is shown by the dotted lines from the point *b* to the sides. It will be noted that the figures on the sides are inclined and this inclination is the key to the way the line should run from the point to the particular side. Thus the inclination of the figures shows that the lines for the medium and fine percentages should run to the left.

The system for point *a* is simpler and one can read the point almost without looking at the scales. But the system for point *b* seems to be more used and familarity makes it as easy to read as the other.

An interesting feature is that either system may be converted to the other by changing the names of the sides. Thus *b* would

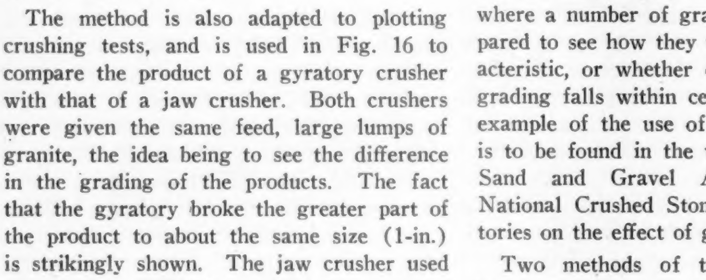


Fig. 17. Triaxial plot for comparing gradings

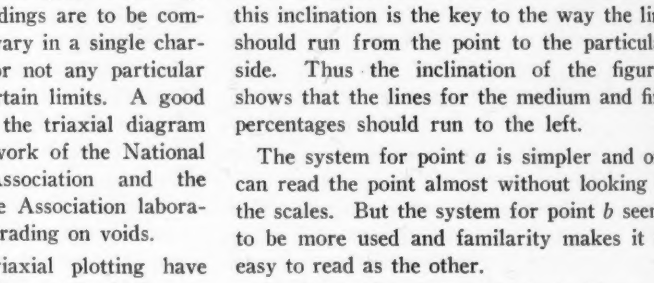


Fig. 19. Method of finding range of mixes having same fineness modulus

be read the same as *a* is read if the side marked medium were to be marked fine, the side marked coarse marked medium, and the side marked fine marked coarse. This shows that the two methods of triaxial plotting are really the same.

Since there are only three sides to a triangle only three components can be plotted. For aggregates, these are taken as coarse, medium and fine. For sand, the National Sand and Gravel Association took the coarse as No. 4 to 14, the medium as No. 14 to 48, and the fine as all passing No. 48. (These are Tyler standard sieves.)

After many mixtures of fine, coarse and medium had been tested for voids and the percentages of voids set down on the points representing the grading of these mixtures, the figures were found to form curves. These curves are the heavy lines shown in Fig. 18. This is one of the great advantages of the triaxial diagram. It can be made, as in this case, to show *all possible* mixtures of fine, coarse and medium sizes and just which mixtures will have the same proportion of voids or other characteristic.

The shaded area in this figure shows another advantage of the triaxial plot, that of showing specification limits or the like by an area. In this case the area represents mixtures of fine, coarse and medium that will meet many specifications for concrete sand. A glance at it is enough to show that these specifications might well be modified, for surely sands with 44% voids and 36% voids cannot be anywhere near equal in mortar making qualities.

The triaxial diagram is useful in solving some problems graphically. An example is that of finding the range of mixes of three components to have the same fineness modulus. The method is shown in Fig. 19. A mixture of fine and coarse for the desired fineness modulus is figured and this locates a point on the coarse side. A mixture of medium and coarse is figured and this locates a point on the medium side. These points are connected and every point on the line so drawn will represent a mixture having the same fineness modulus.

The "Best" Method of Plotting

Having studied all these methods one may conclude that there is no "best" method of plotting the sieve analysis. The method to use is that which will give the clearest mental picture and emphasize those characteristics of the grading in which there is the most interest.

At one time the writer would have advocated throwing out all but the log-scale method of plotting. He still believes that it has the widest application and is the best method of keeping record graphs of an aggregate plant. If the log-scale graph used is a conversion chart so that any desired sieve or grain dimension may be readily interpolated, it is all the graph that anyone needs.

For comparing samples with an ideal grading Cortelyou's chart is clear and simple and it has proved its value by some years of use. It is recommended not only for its simplicity but because so much information can be plotted in a little space.

The method used by Dr. Kriege is very valuable for the comparative study of gradings, as it emphasizes so plainly the "peaks and valleys" of a grading. The writer finds it somewhat confusing where several gradings are plotted together, as the lines do not run in the same general direction as they do in the cumulative plots. But greater familiarity with the method would probably overcome this.

The other plots noted, the crushing diagram, percentage plot and area plot, are all well adapted to show the products of the same machine. It would pay producers well to study such plots and use them more to evaluate the work of their machines. When one becomes familiar with such a plot a mere glance at the curve is enough to warn him that something is not going well or that some new factor has entered into the operation. Graphs in old records will show at a glance conditions that might otherwise require hours of hunting through records to find.

Probably the direct cumulative plot with arithmetical scale, the first described, is the most illustrative for the concrete and aggregate industry. The fact that so many graphs in the literature of concrete and concrete aggregates are plots of this kind gives it a value that no other form of plot can have. Everyone interested knows what Fuller's curve, Talbot's *m* curves and other curves of the same kind look like in the direct cumulative plot. But none of them are recognizable in the log scale plot until one has seen them many times.

However, those who make such plots should make a separate plot for the grains from 200 mesh to ¼-in. If this is done the plot can be made perfectly readable and still be kept in a reasonable space, as is shown in Fig. 2.

For fine materials, accurate plotting of fractions of 1%, and for showing differences in grading more definitely than can be shown with arithmetical scales, the double log-scale plot is preferred.

In conclusion, the writer hopes to see a greater use made of plotting, believing that any one who forms the habit of keeping plots as records will find that the little trouble it takes to graph a sieve analysis on a standard form is paid for many times over by the better understanding gained both of the product and the method by which it is made.

Carbonizing Properties of Coal

A TECHNICAL PAPER, No. 525, on "Carbonizing Properties and Constitution of Pittsburgh Bed Coal from Edenborn Mine, Fayette County, Pennsylvania," has been issued by the Bureau of Mines.

Chemical Engineering Catalog Issued

THE 1932 edition of the Chemical Engineering Catalog has been issued by the Chemical Catalog Co., Inc., New York City.

This 847-page book contains very complete data on equipment and materials used in various industries in which chemical processes of manufacture are used. Rock products producers whose products are advertised include the Hunkins-Willis Lime and Cement Co., Kelley Island Lime and Transport Co., Louisville Cement Co., and the United States Gypsum Co.

A technical and scientific books section catalogs and briefly describes a very complete list of books on chemical and related subjects.

Discusses Nonmetallic Minerals

A SECOND ISSUE of *Sands, Clays and Minerals* has been published by Algernon Lewin Curtis, Chatteris, Eng. Articles of interest to producers of rock products include a report on the organization of the British National Sand Association and discussions of rock sections for microscopic examination, minerals and the British Empire, and the modern crushed stone quarry.

Canada's Nonmetallic Mineral Products in July

PRODUCTION of nonmetallic minerals in Canada in July, 1932, have been reported by the Dominion Bureau of Statistics as follows:

PRODUCTION OF NONMETALLIC MINERALS IN CANADA

			Seven months ending July	
		July, 1932	1931	1932
Asbestos	tons	*7,164	*93,534	62,620
Cement	bbl.	457,246	*5,649,697	2,764,893
Feldspar	tons	635	*9,995	4,857
Gypsum	tons	80,144	*433,875	217,019
Lime	tons	27,185	*205,030	187,658

*Revised.

Asbestos Production in Canada

A REVIEW of the manufacture of asbestos products in Canada in 1931 is given in a bulletin recently issued by the Dominion Bureau of Statistics. In the manufacture of these asbestos products, in addition to the asbestos required, silica in some quantities and cement are also consumed. A list of manufacturers of asbestos products in Canada is included.

Sand for Slippery Pavements

SAND PRODUCERS might find a suggestion of producers of calcium chloride useful in poromoting the use of sand on icy pavements. It is suggested that by alternating thin layers of calcium between loads as piles are built up sand can be taken from the piles in freezing weather and distributed with little difficulty.

Opportunities for Using Indicating and Recording Control Instruments in the Rock Products Industries

Part X—Instrumentation in the Ceramic Industry—Tunnel Kilns

By James R. Withrow*
Chairman, the Chemical Engineering Department, Ohio State University

THE PRECEDING ARTICLES emphasized the importance of instrumentation in the automobile, petroleum, chemical and glass industries, where temperature measuring instruments play an important part in successful operation. Without instrumentation they could not have reached their present high development.

This article deals with the importance of instrumentation to the clay burning or ceramic industries. This includes brick, clay ware, white ware and glazed goods manufacture. Like the glass and steel treating industries, high temperature is essential to the successful operation of a ceramic plant. It was not until very recently that indicating and recording temperature measurement instruments together with the newly designd furnaces were placed in operation. Instrument control has taken the guesswork out of the industry and proven its worth in dollars and cents.

Fig. 50. One side of furnace zone of tunnel kiln in a pottery plant

Drying and Its Control

A mass of clay is porous and, when wet, the pores are filled with water, forming zigzag channels or capillary tubes from the interior of the mass to the surface. When drying begins, the water from the surface is evaporated and by capillary action in the minute channels of the piece, the evaporated water is replaced by water from the interior.

The drainage of moisture from the pores, of course, results in the particles of clay moving closer together, which shows up as shrinkage of the piece. It can be easily understood that the bulk of the shrinkage is due to the removal of the pore water which holds the clay particles apart. The removal of the pore water is the first stage of drying.

The safety of drying during the first stage depends upon the relative rate of surface evaporation and replacement. If the water is evaporated from the surface of the ware faster than it is replaced, it is evident that strains will be set up in the piece which are very liable to be relieved by cracking of the ware. However, it would be incorrect to say that proper drying is only accomplished without the introduction of strains. The physical properties of the clay will enable it to overcome minor strains successfully.

The second stage of drying starts as soon as the pore water has been completely removed. The moisture which still clings to the pore walls, called the water of saturation, must be removed next. This can be accomplished under the boiling point of water by bringing the air in direct contact with the moisture in the ware, but the water is no longer carried to the surface by capillary. It is then necessary for the drying medium (air) to penetrate the center of the piece before the second stage of drying or removal of the water clinging to the pore walls is completed.

The shrinkage in the second stage of drying is very much less than in the first stage, since the particles of clay are in close contact after the removal of the pore water. When the removal of the water clinging to the pore walls is completed, the piece is said to be bone dry. It can be easily understood that the clay can never become drier than the air used as drying medium. Air is never completely dry, so there is always some moisture remaining in the ware after the completion of the second stage of drying.

After the completion of the first two stages of drying, both of which can be carried on below 212 deg. F., there still remains in the ware all the chemically combined and so-called colloidal water. This cannot be removed without raising the temperature above the boiling point. The removal of this water is accomplished in the kiln during the "water-smoking period" and is a burning problem rather than a drying problem. This occurs between 212 and 800 deg. F.

Moisture removal from clay during the first two stages is accomplished by evaporation, which depends on the following:

1. The temperature and vapor pressure of the moisture (relative proportion of moisture) in the material.
2. The temperature and vapor pressure of the moisture in the air.
3. The velocity of air over the surface of the material.
4. The physical property of the material being dried.

Each of these factors, except the last, can be and should be accurately controlled.

The first problem in drying is to establish the most efficient drying schedule according to the physical properties of the material;

*The author is indebted to Dr. Wei Yang, the Harrop Ceramic Service Co., and the Engineering Experiment Station of Ohio State University for assistance in the preparation of this paper.

that is, to establish the fastest drying schedule which the material will stand. After this has been done, it is necessary to devise some control method which will enable the most efficient drying condition as shown by the drying schedule to be duplicated again and again. The factors which must be controlled to produce such conditions are ordinarily temperature, humidity and air movement. The vapor pressure can be measured by means of a manometer, but since vapor pressure is dependent on temperature and humidity, it is more commonly controlled through the control of these conditions.

Temperature in the dryer is unquestionably of great importance. It requires a definite number of heat units to evaporate a given quantity of water regardless of whether it is applied slowly or rapidly. Heat must not be applied so fast, however, that a dry skin is formed on the outside of the piece which would prevent the passage of water from the inside of the ware. It should be borne in mind that the maximum drying rate is not necessarily the most efficient due to the additional total heat required to evaporate water at increasingly high temperatures. It is not possible to get good drying conditions solely by regulating the heat, as its effectiveness depends in part upon other conditions, such as humidity.

Humidity control is probably the most important factor in successful drying, although not always realized as such. The term humidity means the amount of moisture contained in a unit volume of air, but is also taken to mean relative humidity, which is the significant figure. Relative humidity is the ratio of the amount of water contained in the air to the amount which it is capable of holding, expressed in per cent. If air has a relative humidity of 50%, it means that the air contains half as much moisture as it is capable of holding. The capacity of air for water is increased by raising the temperature and decreased by lowering the temperature. Relative humidity can be lowered by simply heating the air or can be increased by cooling the air, provided that no change in moisture content has taken place.

It is apparent that a high relative humidity means slow evaporation and consequently slow drying, and vice versa. Low relative humidity means fast evaporation and drying. This, then, offers a means of heating the ware up without danger of cracking or spalling from fast drying and is very often desirable when the characteristics of the material are such that the surface is liable to dry into a hard skin and obstruct the passage of water from the inside of the piece. If the relative humidity is kept high by some kind of a humidifier, no drying will take place while the heat is being raised and as a result the body is heated equally throughout. When the relative humidity of the air is then decreased, the moisture (in effect) evaporates from the center of the piece equally as well as from the surface, thereby assuring a completely dried piece which is free from dryer defects. It should be noted here that drying takes place more rapidly under higher temperatures, even with the relative humidity the same, than with lower temperatures.

Control of the air movement in dryers is also an important factor in successful drying. Air serves two purposes: first, to convey the heat to the clay body; and second, to sweep away the saturated vapor from the surface. Up to a certain velocity the rate of evaporation at a constant temperature is dependent on the velocity of air over the surface.

The theory has been advanced that two distinct periods should be recognized in drying clay ware and best results can only be obtained by arranging the controls accordingly. The first period covers the drying of the piece from the time it is formed until it reaches the leather-hard stage, thereby setting up strains before most clay workers think it necessary to give the drying ware any attention at all. It is thought that control of the rate of drying during the first stage would decrease the drying losses.

Burning Clay Ware

In the burning of clay ware in the kiln, it is necessary to control the temperature with respect to time, the condition of the fire (whether oxidizing or reducing), draft or distribution of heat, fuel supply and combustion. This control is necessary both in periodic kilns and in continuous kilns. Ware burning in kilns must go through three stages, each requiring different conditions: the water smoking period; the oxidation period, and the finishing period.

During the first stage, in which the chemically combined water is driven from the ware, the most important consideration aside from raising the temperature steadily is the provision of a draft sufficiently strong to carry the moisture-laden air from the kiln. This is extremely difficult due to the kiln and stack being cold. If the "water gas" is not carried off as fast as formed, the water smoking period is necessarily lengthened.

During the second stage, or the oxidation period, is accomplished the oxidation of carbon, sulphur and ferrous oxide (common constituents of clays), the decarbonation of the carbonates and other chemical changes. It is important to have accurate control of the temperature during this period to be sure that it does not go high enough to vitrify the outside of the ware and cause it to become impervious to the passage of the gases. If this happens, bloating of the ware is liable to result due to the formation of carbon dioxide gas when the carbon in the clay at the interior of the ware is heated. If the heat is brought up gradually the ware is heated equally throughout, and when the outside finally reaches the vitrification point, the carbon contained in the body will have been completely oxidized. The safe rate at which the temperature may be increased during this period is found only by trial.

Of equal importance to the control of temperature during the oxidation period, is the control of furnace conditions in such a way

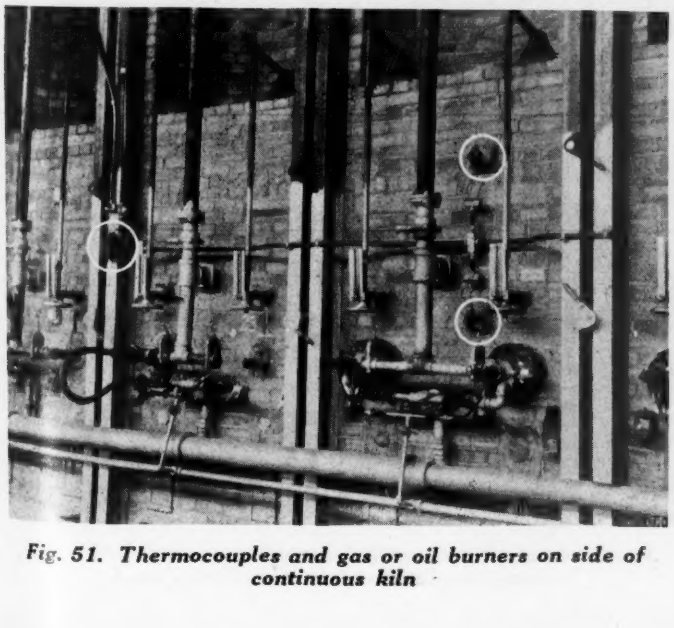


Fig. 51. Thermocouples and gas or oil burners on side of continuous kiln

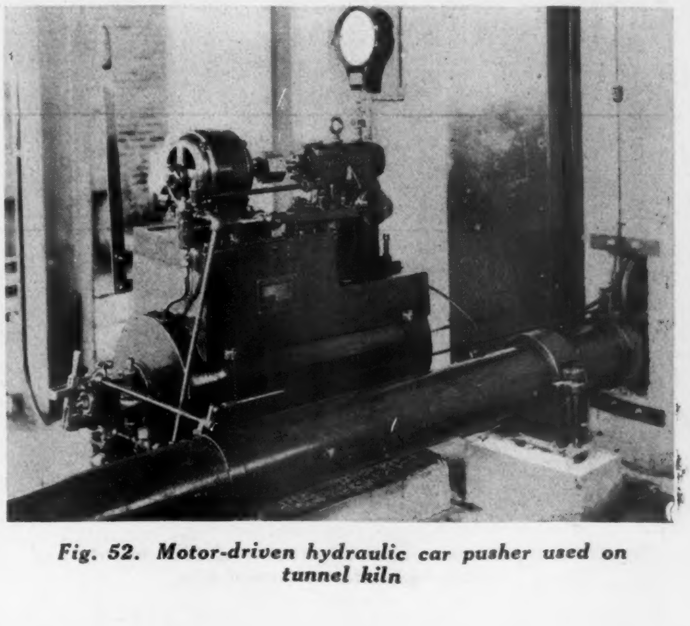


Fig. 52. Motor-driven hydraulic car pusher used on tunnel kiln

that the kiln is kept continuously oxidizing. This is done by providing an excess of air. Some burners, however, go too far in the opposite direction and, thinking that a smoke-free stack is proof of good burning, introduce so much air that the efficiency of the furnace is lowered considerably due to dilution of the gases. The only sure way to determine the correct amount of excess air is to keep a constant check on the combustion gases.

The treatment of ware during the third stage of burning or the finishing period is largely dependent on the class of ware being manufactured. In salt glaze stone ware it is necessary to reduce the kiln temperature strongly at the end of the burn to get best results from the application of the salt. In burning porcelain, the fire is sometimes reduced near the end of the burn to produce the bluish-white cast which is a characteristic of some porcelain. Proper reduction, like proper oxidation, can best be controlled by analysis of the flue gases.

The treatment of the ware during the glaze burn also depends upon the type of ware or glaze being fired. Some glazes require only oxidizing conditions, while others must be reduced to secure desired results. Examples of glazes which can be fired under reducing conditions are certain copper glazes, uranium glazes, and salt glazes such as are used on stoneware.

Tunnel Kilns

Under old methods of manufacture, various ceramic products were fired in round or rectangular, periodically operated kilns, which were frequently spoken of as beehive kilns, because of their resemblance to an old fashioned beehive. Another type commonly used in potteries has the shape of a gigantic milk bottle. These old fashioned kilns, which are intermittent in their operation, are constructed of brick with a firebrick lining. They are filled with the ware to be fired, then the door or entrances are built in with brick and sealed with clay. The fires are applied through the various fireboxes located around the kiln proper. The heat is gradually increased until a maturing temperature is reached, after which the kiln with its fired ware is allowed to cool, care being taken to prevent cracking or denting due to too rapid cooling. After the temperature has been reduced sufficiently, the entrances are opened and the ware removed, completing the cycle of operation.

Under this method of firing, the fuel consumption is high due to the fact that, in addition to heating up the ware, it is necessary to heat the entire kiln structure as well. Other heat losses during the firing period are due to radiation from the exterior of the kiln and in the highly heated chimney gases. In cooling, a large percentage of heat is thrown away, due to difficulty of recovering it and using it to advantage. Another loss, equally as great, is in the lack of uniformity of the ware. Because of the great mass of the ware placed in the kiln at any one time and because the heat can only be applied on the outside, it is impossible to obtain evenness of temperature through the entire setting. This means a large percentage of overburned, as well as underburned, products which must be disposed of at a sacrifice. Because of the intermittent character of the work, labor cannot be used economically. The continued heating and cooling of the kiln also results in frequent expanding and shrinking of the brick, causing damage to the walls and crown and necessitating constant repairs.

In an effort to overcome these defects of the old system, tunnel kilns like the Harrop tunnel kiln were developed. The Harrop car tunnel kiln consists of a tunnel from 150 ft. to over 500 ft. long, with a battery of furnaces approximately midway of its length and through which a solid train of cars are constantly moving, each carrying a setting of ware, placed upon a refractory platform.

The kiln cars have one-piece semi-steel cast frames with chilled wheels and roller bearings. The car platform consists of heavy refractory blocks, resting upon a bed of heat insulating material to protect the frame and running gear against the heat. The transfer cars are of structural steel with large diameter wheels and roller bearings. These may be electrically operated.

Fuels, either gaseous, liquid or solid, are burned in furnaces directly connected to the tunnel and the heat is transferred to the ware with such efficiency that 60 to 85% of the fuel is saved through the use of the tunnel kiln and temperature instrumentation over the old method of firing.

Fig. 50 (courtesy Wilson-Maeulin Instrument Co.) shows one side of the furnace zone of the Harrop kiln at a large pottery at Crooksville, Ohio, with automatic motor operated fuel control valves for the air and gas lines. Accurate temperature control is vital for uniform ware production, as well as for fuel economy, so that indicating and recording pyrometers are used on the kiln. They are usually placed on different sections of the roof of the kiln, but sometimes on the floor section between the car rails. Base metal couples are generally placed in the lower temperature regions and platinum-rhodium couples in the highest temperature. All couples are compensated by extended cold junctions for proper comparison.

Fig. 51 (courtesy Bacharach Industrial Instrument Co.) shows the installation of thermocouples on the side of a continuous kiln along with gas or oil burners. The pyrometer couples are connected through a

Fig. 54. Automatic temperature control instruments and indicating panel on tunnel kiln

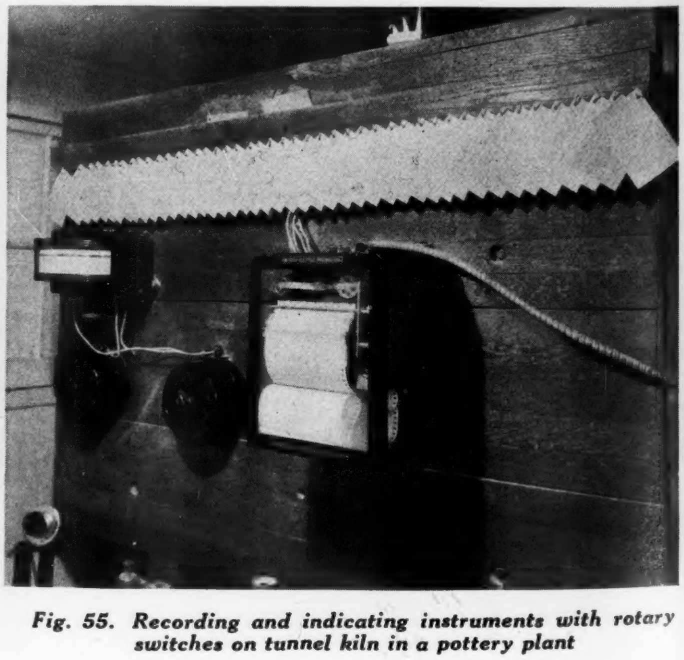


Fig. 55. Recording and indicating instruments with rotary switches on tunnel kiln in a pottery plant

dust- and fume-proof rotary switch to an indicating instrument from which readings are taken at regular intervals. At the same time, high temperatures are recorded by recording instruments, so that the trend of kiln temperatures can be observed at all times by the operator, and so that a check on the work of the operator is maintained at all times for supervisory purposes.

Fig. 53 (courtesy Bacharach Industrial Instrument Co.) shows the instrument board for a tunnel kiln with a recording pyrometer at the lower right and double range indicating instruments at the upper left.

Fig. 54 (courtesy Wilson Maeulen Co.) shows the instrument panel in a large pottery plant with eight automatic temperature control instruments, one for each burner in the Harrop kiln, and also an indicating instrument panel with a high resistance monopivot indicator of double range type, and a rotary selector switch for readings of temperatures in all parts of the kiln.

Fig. 55 shows the instrument board and installations of Brown pyrometers on a Harrop kiln at a large pottery plant. The recording instrument is on the right of the board, while the indicating instrument together with two multiple rotary switches to indicate all the temperatures of the kiln are shown on the left. On top of the instrument board is a rack containing a number of small sliding blocks, each corresponding to a car in the kiln. These blocks have small hooks on which are hung tags showing the kind of ware held by the cars and are moved through the rack as the car itself moves through the kiln, so that the position and contents of any car can be readily determined and the time of production predicted.

The cars of green ware are introduced singly at the charge end of the furnace and are moved through the tunnel by a hydraulic pusher. Fig. 52 (courtesy Harrop Ceramic Service Co.) shows the installation of a car pusher, on a Bisque kiln, in a West Virginia plant.

As the ware proceeds through the tunnel it absorbs heat from the surrounding gases and the temperature of the ware gradually rises until in the furnace section the maximum and maturing temperature is reached. Thus the ware undergoes ideal firing conditions.

After passing the furnace the fired ware continues to move toward the discharge end of the kiln, gradually giving up its heat to incoming fresh air, which serves as preheated air for combustion and which proceeds with the furnace gases toward the charging end of the kiln to preheat the oncoming ware. The fired ware finally is withdrawn from the kiln at a relatively low temperature.

Thus, the operation of the kiln is fully regenerative in that the only heat which must be supplied to the kiln is the small amount necessary to retain the final temperature of the ware in the furnace section. Therefore only a minimum amount of fuel is required.

Fig. 56. Result of cone test in tunnel kiln, showing uniformity of temperature

The firing of clay products was, and still is in many places, controlled by a comparison of pyrometer cones, but the Harrop kiln can do away with the cones because of the automatic temperature control instruments. The cones are sometimes used, however, as a check on the temperatures, as when heat treatment throughout the entire car setting of a tunnel kiln is of great importance. This is especially difficult at a high rate of production, unless the kiln is properly designed.

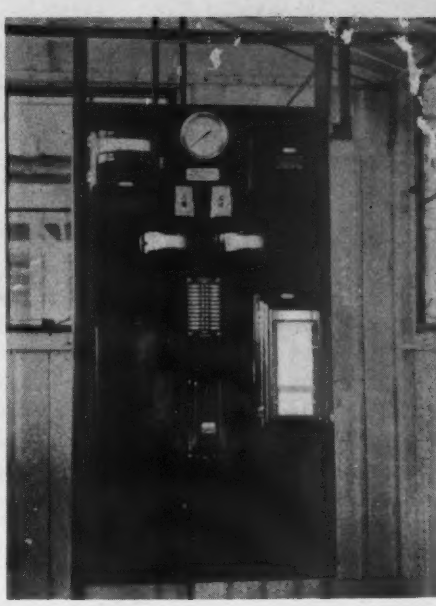


Fig. 53. Instrument board for tunnel kiln at a pottery plant

Fig. 56 shows cones 10, 11, 12 and 13 taken from the entire cross-section of a kiln car setting and indicating the temperature variations. This test is carried out once each month at an Ohio plant, and the illustration is typical of the results. In a tunnel kiln the question is, "can you burn to the same heat at every spot on the car without damaging the outside ware by excess heat?" Each of the 33 cones was set among the ware so as to systematically cover all points in a vertical section of the car. Each vertical row of ware, of course, advances through the hot zone and in turn gets the same heat history for the same interval. The cone plaques each contain four cones graduated in composition so as to soften under heat slower than the previous one. In the case of "center—1" the heat melted down completely the left-hand cone; the next is melted over until it almost flattened itself; the third has bent over; and the fourth has started to curve. This shows a definite heat experience. Now, if each plaque was alike at the start, then each has had just the same heat experience and the ware has passed through the same heat in every part of the vertical section of the kiln.

The advantages of continuous kiln over periodic kiln are:

1. More uniform quality of product due to uniform firing and small amount of ware carried.
2. Large fuel saving due to regenerative operations.
3. Reduced kiln labor, easily 25% less.
4. Lower kiln maintenance due to uniform temperature and constant temperature gradient throughout the kiln.
5. Uniform and continuous production which increases production and profit.
6. Decreased time to manufacture due to small masses under fire at one time.
7. Reduced stock of finished ware due to the shortening of firing time means less working capital required.

(To be continued)

Mining Methods and Costs at the Hart Spur Pit of the Fort Worth Sand and Gravel Co., Fort Worth, Tex.*

By Thomas E. Popplewell†
Secretary, Fort Worth Sand and Gravel Co.

THE pits of the Fort Worth Sand and Gravel Co. are located along the Trinity river, from Fort Worth eastward to the Tarrant county line and adjacent to the Rock Island railway to which the standard-gage gravel-pit track is connected at Hart Spur.

Two types of gravel deposits are found in Tarrant county: river gravel, which is found in the lowlands and consists of rounded clean pebbles and sand with little or no cementing material; and pit gravel, which is found in the upland or earlier river bottoms and consists of angular particles mixed with clay and other foreign matter and particularly with plastic clay balls. The upland deposits are usually thicker and have heavier overburden; otherwise the two types of deposits are quite similar. These deposits were washed down the Trinity river from disintegrated medium-hard limestones upstream. The deposition of the material seems to have been caused by the interference of small tributaries, as the deposits are almost invariably found on the upstream side and immediately adjoining the mouths of the small streams. The deposits vary in size from a few acres to over a hundred acres and exist mostly on the north side of the river. The deposit at Hart Spur consists largely of river gravel, but there are some adjacent upland gravels. At the time of this report the river gravel only was worked.

The deposit is overlaid with about 2 ft. of top soil and 3 to 8 ft. of clay. This overburden forms about 40% of the total material handled, and is cast back into the pit made by previous excavations. The sand and gravel stratum is 8 to 25 ft. deep and is usually underlaid by blue shale. The average size of commercial deposits is about 70 acres and they are usually triangular in shape. The material is loose and runs approximately 40% sand and 60% gravel. The sand and smaller sizes of gravel are siliceous, whereas the larger gravel is mostly limestone.

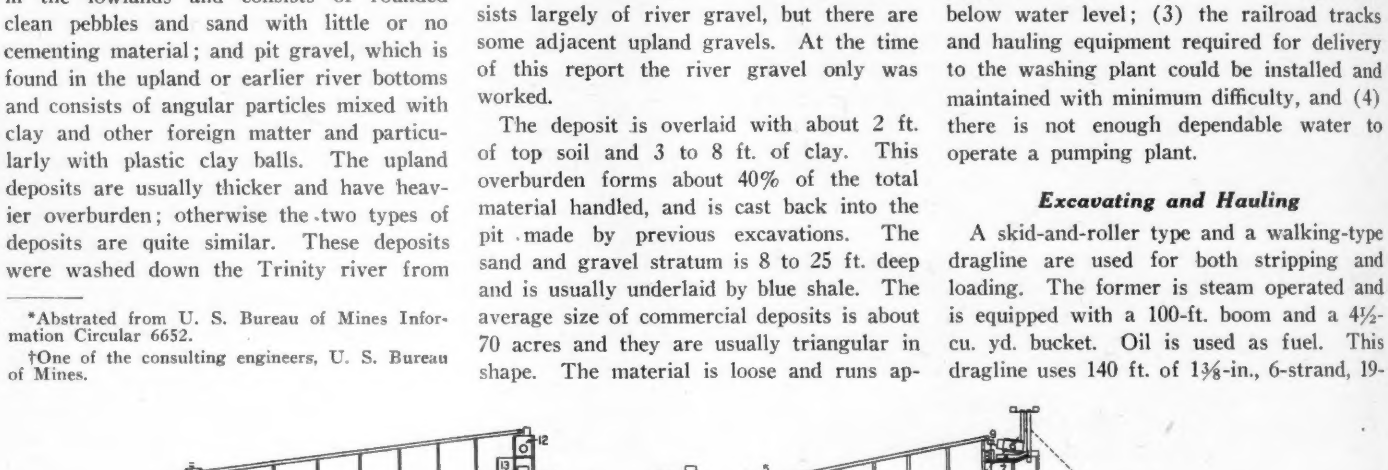
The dragline was chosen as the best means of excavation, for the following reasons: (1) The deposit is shallow, the average depth to the bottom of the gravel being 20 ft., requiring frequent moving of excavating equipment; (2) 4 to 10 ft. of the deposit is below water level; (3) the railroad tracks and hauling equipment required for delivery to the washing plant could be installed and maintained with minimum difficulty, and (4) there is not enough dependable water to operate a pumping plant.

Excavating and Hauling

A skid-and-roller type and a walking-type dragline are used for both stripping and loading. The former is steam operated and is equipped with a 100-ft. boom and a 4½-cu. yd. bucket. Oil is used as fuel. This dragline uses 140 ft. of 1⅜-in., 6-strand, 19-

*Abstracted from U. S. Bureau of Mines Information Circular 6652.

†One of the consulting engineers, U. S. Bureau of Mines.



General arrangement of the Hart Spur plant of the Fort Worth Sand and Gravel Co.

w e, Lang-lay cable with independent wire-rope cent r as a drag cable. The life of the cable is approximately three months. For hoisting, a 6-strand, 19-wire, regular lay, hemp-center ⅞-in. cable 440 ft. long is used. This cable lasts approximately eight months under average conditions.

The walking-type dragline is powered by a 120-hp., 2-cyl. Diesel engine and is equipped with a 70-ft. boom and a 3-cu. yd. bucket. It has 110 ft. of 1¼-in., plough-steel, 6-strand, 19-wire Lang-lay drag cable with wire-rope center. The hoist cable is 220 ft. long, ⅞-in. diam., 6-strand, 19-wire, plough-steel, regular-lay with hemp center.

This machine operated 4200 hours during 1931 and consumed 34,224 gal. of distillate, or 0.10 gal. per ton of sand and gravel mined. The price was 2½ c. per gal. The operating cost per ton with this machine is considerably less than with the steam machine and for that reason it is used more.

The sand and gravel is loaded into drop-bottom railroad cars and hauled 3½ mi. to the washing plant by steam locomotives. Two 90-ton locomotives are used. During the year the locomotives worked 7380 hours and consumed 9990 bbls. of fuel oil, or 0.0292 bbl. per ton of sand and gravel mined.

Screening and Washing Plant

At the plant the cars are emptied to a 15- by 30-ft. concrete track hopper which has a capacity of 150 tons and is covered with a rail grizzly having 4-in. openings. From the hopper the material is fed by a 30-in. plate feeder to a 30-in. by 185-ft. inclined belt conveyor which delivers to the scrubber section.

Any material that passes the grizzly but is too large for commercial use is thrown off the belt by hand into a 12-in. jaw crusher set to crush to 2-in. The crushed material is carried back to the main conveyor by a 16-in. inclined belt conveyor.

The main conveyor delivers to a mixing box 50 ft. above the bottom of the hopper. This box, 4 ft. square and 3 ft. deep, is made of wood and lined with steel plate. An 8-in. stream of water discharging into it mixes the material and washes it through an opening into the main washing screen. An 8-in. centrifugal pump driven by a 50-hp. ball-bearing motor forces 1200 gal. per min. into the mixing box.

The main screen is a heavy-duty cylindrical scrubber, 6 ft. in diameter and 20 ft. long. The first 5 ft. is a solid section with baffles of 3-in. angle iron. The next 15 ft. is made up of ¼-in. steel plate perforated with ⅜-in. round holes. Surrounding the screen is a sand jacket of wire cloth with ⅛-in. square openings.

Ordinarily the ⅜-in. screen lasts one year, while the sand jacket has to be renewed at the end of six months. The sand and water passing the sand jacket is flumed to two sand classifiers of the drag type having flights 5 ft. long and 6 in. wide, spaced at 1-ft. intervals and traveling 25 ft. per min.

The sand from the classifiers is carried to the first storage pile by a 24-in. by 172-ft. inclined belt conveyor.

All sizes of material above ⅛-in. are discharged from the end of the cylindrical screen on to a belt conveyor and carried to the top of the plant for sizing and distribution to storage piles. The gravel is conveyed by a series of short belt conveyors, 55 to 65 ft. long, to a series of six 4- by 7-ft. vibrating screens. The screens on these vibrators last from 6 to 15 months, depending on the mesh size. The larger screens wear out more quickly, as they carry a larger load. At each successive screen the oversize is screened out and carried to storage, and the undersize goes to the next screen. Wire screens are used on these vibrators, the size of openings beginning at 3 in. and diminishing to ¼-in.

Some sizes, notably brick sand, ¾- to ½-in. gravel, and ½- to ¼-in. gravel, are made in excess quantities, especially during the winter months. A slack-line cableway drags this surplus away from the plant in the direction indicated by arrows on the

TABLE I—SUMMARY OF COSTS AT HART SPUR PIT JANUARY 1 TO DECEMBER 31, 1931

Overburden removed (estimated) 288,000 tons
Sand and gravel loaded 341,633 tons
Sand and gravel washed 288,279 tons

Cost per dry ton of sand and gravel mined.

	Labor	Supervision	Power	Fuel	Supplies	Total
Stripping and mining	$0.0323	$0.0123	....	$0.0034	$0.0110	$0.0590
Track maintenance	0.0289	0.0047	....	....	0.0071	0.0407
Transportation	0.0050	0.0010	....	0.0195	0.0040	0.0295
Pit maintenance	0.0055	....	....	....	0.0260	0.0315
Washing plant	0.0481	0.0073	$0.0207	....	0.0082	0.0843
Plant maintenance	0.0053	....	....	....	0.0157	0.0210
Total direct operating cost	$0.1251	$0.0253	$0.0207	$0.0219	$0.0720	$0.2660
Depreciation	....	....	....	....	....	0.0630
Depletion	....	....	....	....	....	0.0216
Total operating cost	....	....	....	....	....	$0.3506

Washing-plant operating cost based on tons washed.

	Labor	Supervision	Power	Fuel	Supplies	Total
Washing plant	$0.0568	$0.0083	$0.0245	....	$0.0097	$0.0993
Plant maintenance	0.0062	....	....	....	0.0186	0.0248
Totals	$0.0630	$0.0083	$0.0245	....	$0.0283	$0.1241

TABLE II—SUMMARY OF COSTS IN UNITS OF LABOR, POWER AND SUPPLIES AT HART SPUR PIT; PERIOD, JANUARY 1 TO DECEMBER 31, 1931

	Stripping	Mining	Crushing	Total per ton of sand and gravel loaded
A. Labor (man-hours per ton):				
Loading	0.034	0.044	....	0.073
Transportation	....	0.043	....	0.043
Plant	....	....	0.031	0.026
Supervision	....	....	....	0.009
Total	0.034	0.087	0.031	0.151
Average tons per man per shift				65.8
Labor, per cent. of total operating cost				42.8
B. Power and supplies (per ton of sand and gravel loaded):				
Dragline, distillate			gal.	0.1002
Locomotive, fuel oil			bbl.	0.0292
Washing plant			kw.h.	0.0725
Fuel and power, per cent. of total operating cost				12.0

TABLE III—DETAILED AVERAGE DRAGLINE COSTS AT HART SPUR PIT; PERIOD, JANUARY 1 TO DECEMBER 31, 1931

Monighan dragline, 3 cu. yd. bucket.
Overburden removed (estimated) 288,000 tons
Sand and gravel loaded 341,633 tons

	Sand and gravel (341,633 tons)		Overburden (288,000 tons)		Total (629,633 tons)		Total cost per ton of sand and gravel
	Amount	Cost per ton	Amount	Cost per ton	Amount	Cost per ton	
Engineers	$1,950.00	$0.0057	$1,300.00	$0.0044	$3,250.00	$0.0051	$0.0095
Firemen	1,540.00	0.0045	1,110.00	0.0038	2,650.00	0.0042	0.0077
Foremen	2,520.00	0.0073	1,680.00	0.0058	4,200.00	0.0061	0.0123
Pitmen	1,465.00	0.0043	975.00	0.0034	2,440.00	0.0039	0.0072
Other labor	1,620.00	0.0047	1,080.00	0.0037	2,700.00	0.0043	0.0079
Total operating labor	$9,095.00	$0.0265	$6,145.00	$0.0211	$15,240.00	$0.0236	$0.0446
Fuel	698.33	0.0022	465.55	0.0016	1,163.88	0.0018	0.0034
Grease and supplies	2,254.55	0.0061	1,500.00	0.0052	3,774.55	0.0059	0.0110
Total supplies	$2,952.88	$0.0083	$1,965.55	$0.0068	$4,938.43	$0.0077	$0.0144
Shop labor	1,145.52	0.0033	760.00	0.0026	1,905.53	0.0030	0.0055
Repair supplies	5,373.94	0.0158	3,520.00	0.0122	8,893.94	0.0141	0.0260
Total repairs	$6,519.46	$0.0191	$4,280.00	$0.0148	$10,799.46	$0.0171	$0.0315
Total dragline	$18,567.34	$0.0539	$12,390.55	$0.0427	$30,977.89	$0.0484	$0.0905

plant. These materials are reclaimed by reversing the cableway bucket. This storage is necessary because of the seasonal demand for the fines. The cableway is equipped with a bottomless ½-yd. bucket, pulled by a ⅝-in. cable. The track cable is ½-in. Both cables last about one year. The cableway is powered with a 15-hp. motor.

The plant will easily wash and store 250 tons of material per hour and the storage will hold over 30,000 cu. yd. without dragging any material away from the plant. The scraper more than doubles this storage capacity. The storage piles are on the ground with no division wall between them.

A loading-out tunnel 7 by 7 ft. inside and 400 ft. long lies under the storage piles. Under each pile are three or four 16- by 16-in. manually operated clamshell gates for drawing the material on to a 24-in. by 475-ft. conveyor which carries it to the top of the loading tipple.

All belts in the plant are made of 5-ply 32-oz. duck with ⅛-in. rubber top and 1/16-in. rubber bottom. The short belts are all driven by 5-hp. ball-bearing motors, through gear connection.

The grading of the gravel is done on the tunnel belt; that is, the various sizes are put on the belt in the proportions necessary to meet specifications. The plant foreman looks after the grading and checks it by making screen analyses, taking samples from the car-loading chute. At the loading tipple the sand is dropped directly into the railroad cars through a flop gate, but gravel is diverted into a cylindrical screen 4 ft. in diameter and 10 ft. long, where it is sprayed by a stream of water to rinse off dust that has accumulated in the stockpile. The various sizes of gravel carried on the belt are thoroughly mixed by the rinsing screen before going into the car. The chute for loading cars is hinged so that it can be swung from one side of the car to the other to prevent segregation of sizes.

The washing plant consumed 247,900 kw. hr. during 1931 or 0.0725 kw. hr. per ton of sand and gravel mined.

About 60% of the material mined is sold as sand and gravel and 40% is wasted. Of the 60% saved, 24% is sold as washed gravel, 18% as washed sand, and the other 18% as pit-run sand and gravel. The latter is used for railroad ballast and in making concrete base for streets.

Physics of Plastering

THE ANNUAL REPORT of the (British) Building Research Board for the year 1931, recently published, under the caption "Physics of Plastering," contains the following interesting observations:

"The properties desirable in a plastering material are readiness to adhere to wall surfaces, ease of spreading and smoothing off, and when used over lathing, expanded metal or the like, the power of forming suitable keys. Other properties required are a suitable rate of hardening, absence of volume changes, good appearance and cheapness; in connection with the last, the amount of sand which can be added is of importance.

"The workability and the sand-carrying capacity of a plastering material are both the resultants of a number of complex factors, and while the flow-table provides a reliable measure of the workability of a lime plaster and a good idea of its sand-carrying capacity, the test methods are purely arbitrary. The property of forming keys can, at present, only be adequately dealt with by actual trial. The effect of adding a little more sand than is suitable can be readily seen, the keys becoming ragged and the droppings large. Systematic observations in plastering trials with skilled craftsmen have enabled approximate estimates of sand-carrying capacities to be made. Some progress has also been made in this manner in determining the influence of the type of sand used on the properties of a plaster mix.

"The effect of the grading of sands has been studied and it has been shown that grading has a very great influence on the amount of sand that can be carried by a given lime. On the other hand, it is doubtful whether the actual shape of the sand grains, i.e., whether rounded or irregular, has within wide limits, any appreciable influence on the plastering quality of a sand.

"In plastering terminology, the term 'sharp' sand should not be used to denote an angular sand since, as noted above, the grain shape is unimportant, but a sand which is badly graded. A sand which would be considered very good by a practical plasterer can be made by combining in suitable amounts two or three angular sands, each of which is of uniform but different size, provided the relative sizes are suitable."

Factors Affecting Concrete Strength Tests with Different Aggregates

(Reviewed by Edmund Shaw, Contributing Editor, Rock Products)

STANTON WALKER in the July issue of the *National Sand and Gravel Bulletin* discusses some of the factors that may affect strength tests for the selection of aggregates by competition. One of these is the age at which the test piece is broken. Figures from Portland Cement Association tests given to show the effect of age are included. These give the strength with three aggregates ("A," "B" and "C") as percentages of strength with the fourth ("D").

Aggregate	Compressive strength 7 days	28 days	3 months	1 year
"A"	88	89	88	91
"B"	94	91	91	79
"C"	72	77	82	75

Aggregate	Modulus of rupture 7 days	28 days	3 months	1 year
"A"	107	106	94	86
"B"	105	108	98	94
"C"	89	98	82	82

It is noted that aggregate "A" when tested at early ages was shown to give 6-7% higher concrete strengths than aggregate "D." However, for tests made at later ages, aggregate "A" was found to give 6-14% less strength than aggregate "D."

The effect of using different brands of cement is shown by figures taken by M. O. Withey's paper found in *Journal of the American Concrete Institute,* February, 1931. The concrete was 1 : 2 : 4 by volume, the cement contents, in sacks, being, with aggregate "C," 5.15; aggregate "A," 5.41; and aggregate "B," 5.52.

Cement	Tensile strength*	Concrete aggregate	Compressive strength ratio to aggregate "C" concrete 60 days	90 days	5 years
3M	413	"A"	79	79	82
		"B"	94	91	111
4M	362	"A"	83	83	90
		"B"	90	88	102
5M	386	"A"	102	107	97
		"B"	107	119	98
7M	394	"A"	98	95	100
		"B"	107	102	102

*Tensile strength of briquets at 28 days.

The paper says: "It will be observed that when the low-testing cement was used for comparisons aggregate 'A' was found to produce about 10% higher flexural strength than 'B' in the same concrete mixture. On the other hand, with high-testing cement, aggregate 'A' was found to produce a strength 22% higher than aggregate 'B.'

The association's own laboratory tests show that comparisons between aggregates in concrete may be affected to a remarkable degree by the cement with which they are tested. Results are summarized as follows:

Cement	Ratio of strength tests of concrete (A/B) 14 days	28 days
Modulus of rupture:		
Low-testing standard	110	109
High-testing standard	122	122
High-early-strength (special)	114	114
Compressive strength:	14 days	28 days
Low-testing standard	99	95
High-testing standard	105	106
High-early-strength (special)	106	105

Commenting on these results, the author says: "The importance of such differences in comparisons will be realized in cases where concrete proportions are being selected on the basis of strength tests and where the source of the material to be used depends on the proportions selected."

Other factors mentioned as affecting tests are the proportions of different sizes in a mixture, the method of molding the specimen, and perhaps the method of determining the flexural strength. The author says he hopes to publish a study of this general question, including the effect of other variables, in an early issue of the *Bulletin.*

Carbonizing Properties of Coal from Alabama

THE Bureau of Mines has issued a technical paper, No. 519, on "Carbonizing Properties and Constitution of Washed and Unwashed Coal from Mary Lee Bed, Jefferson County, Alabama."

Hydraulic Limes*

Improvements in Manufacture and Their Possible Future

EXTRAORDINARY results may be expected according to experiments by the application of super-burning and super-quenching to limestone.

Study and experiments for three years with different varieties of limestone of very different chemical composition and sometimes rather heterogeneous physical texture have fully confirmed expectations.

We can no longer doubt of the results to be attained by this method, and it may be said that, in general, it is possible to produce by super-burning and super-quenching with most kinds of hydraulic limestone resistances four to five times greater than the normal ones of 2 to 4 kilograms usually obtained in trials with 1:3 mortar after seven days.

When the chemical composition and physical texture of limestone are favorable for formation of the compounds producing the resistance, it may be expected to exceed 20 kilograms per square centimeter after seven days with plastic mortar 1:3.

In many experiments made with a fine quality of eminently hydraulic limestone it was not unusual to have, after two days, resistances of 14 and 15 kilos., and this is very remarkable. These figures are those obtained in semi-industrial trials and they can easily be demonstrated.

It may be said that these results somewhat upset the theories hitherto accepted as regards the value of the *index of hydraulicity* and other endeavors to class products by formulæ and numbers.

In support and confirmation of this assertion it may be well to observe that the city of Paris has, *for more than a year, abandoned* the indications given by the chemical composition of a product. Nothing but hardening and durability is taken into account, together with retention of form in boiling water. Fineness and apparent density themselves are only noted as supplemental data.

Some examples will explain better than any description what can be expected and obtained with this method of appreciating what becomes of the rules for classification of products according to their chemical composition. All these products retain their form in boiling water. The following is a material the tensile strengths of which, after 7 and 28 days, was 18 and 24 kilos. per cubic centimeter. Its chemical composition is as follows:

Silica	14.30%
Iron and aluminum	8.50
Lime	66.80
Magnesia	0.50
Sulphuric anhydride	0.70
Loss on ignition	8.90

*Translated from the French journal *Revue des Materiaux de Construction.*

A product of different origin gave, after 7 and 28 days, 19 and 26 kilos.

Its chemical composition is:

Silica	17.50%
Iron and aluminum	8.20
Lime	65.80
Magnesia	Traces
Sulphuric anhydride	0.80
Loss on ignition	7.70

Another different product gave, after 7 and 28 days, 20 and 27 kilos.

The chemical composition is:

Silica	15.00%
Iron and aluminum	8.50
Lime	66.20
Magnesia	0.40
Sulphuric anhydride	0.60
Loss on ignition	9.20

Thus the index of hydraulicity for such products hardly corresponds to any but average hydraulic limes, yet their tensile strengths are the same as good cements.

The percentages of these types of materials are rather low, rather great for iron and aluminum, when we consider the ratio $SiO_2 : Al_2O_3 + Fe_2O_3$.

Here, however, are three other kinds of product wherein this ratio is rather high and the percentage of SiO_2 is rich. The resistances given by these products are remarkable.

	A	B	C
Silica	20.40%	16.50%	21.00%
Iron	2.90	1.60	1.80
Aluminum	3.70	2.30	3.50
Lime	65.20	66.10	64.20
Magnesia	1.20	1.30	0.80
Sulphuric anhydride	0.80	1.50	1.20
Loss on ignition	5.56	9.80	6.20

Resistance of plastic mortar 1:3.

	Kilograms		
	A	B	C
Tensile stress after 4 days	10	21	20
Tensile stress after 7 days	23.6	25.7	27
Tensile stress after 28 days	30	31	34

A characteristic of these superior materials is an apparent slight density which may fall to 0.750.

This, however, is a new quality and an advantage, because, with the same percentages in the mixture, fatter and more impermeable mortars can be made, with suitable granular composition of the sand.

These results and anticipations are evidently of a kind to greatly astonish lime and cement workers, and, in particular, encourage hydraulic lime makers to enter into this new path opened out for them, which can and should revolutionize the hydraulic lime industry, just as fused cement revolutionized the artificial cement industry by compelling it to advance in the path of progress with appearance of the "super" and "standard" and qualities of "fused cement" excepting indecomposability in sulphate water.

Thus, we are coming to a new type of material with all guarantee of stability and great resistance like a cement of the finest quality. Greater resistances than those of natural cements, greater than those obtained 20 years ago with the best artificial cements, and even at the present time with ordinary artificial cements.

Experiments made with limestone usually giving inferior products, 1.2 to 1.5 kilos. in 7 days, demonstrated that even in this case the improvement represents resistances of 6 to 8 kilos. after 7 days with 1:3 plastic mortar. It may be said that the process is applicable to manufacture of hydraulic limes.

Mortar Used in the Pyramids

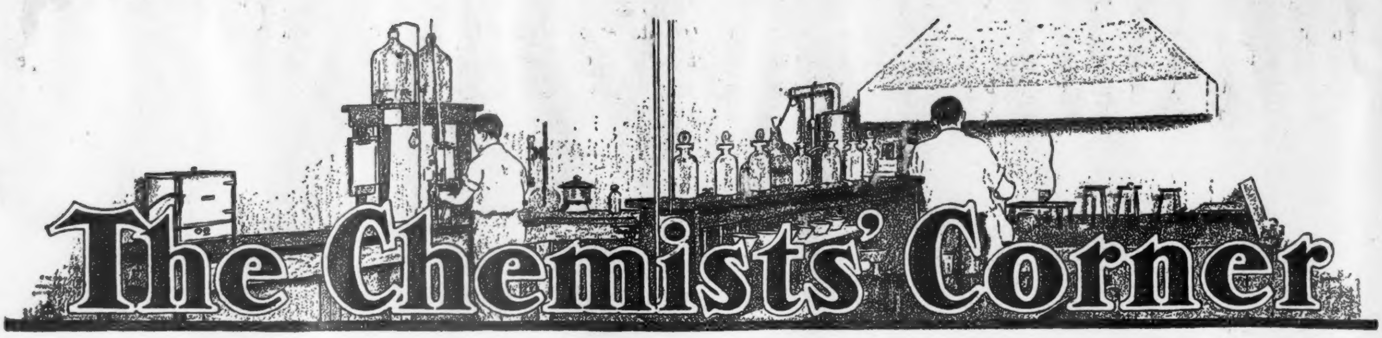
THE MORTAR of the ancient pyramids of Egypt has often been the subject of chemical experiment. Very often, if not always, plaster has been found to be one of the constituents; but as ordinary plaster does not withstand weathering action it has been concluded, as did Professor Glasenapp, a specialist in plaster, that this was not ordinary building plaster but a material burnt at a high temperature, styled "estrichgips" by the Germans, which is proof against the influences of age. This experimenter analyzed two samples of mortar from a pyramid where it was utilized to fill the joints between the blocks of stones around the sarcophagus of Teft-Re, of the Fourth dynasty.

No sand was found in this mortar, which had the appearance of yellowish clay with brown fragments of different hardness resembling grains of burnt clay. The hardness of the samples was similar to that of burnt clay. Microscopic examination and chemical analysis gave the following results:

Loss on ignition, including 3.75 CO_2	23.31%
CaO	31.70%
MgO	0.10%
$Al_2O_3 + Fe_2O_3$	2.00%
SO_3	38.46%
Insoluble in HCl	3.80%
This corresponds to	
$SO_4Ca + 2H_2O$	82.69%
CO_3Ca	8.53%
CO_3Mg	0.20%
$Al_2O_3 + Fe_2O_3$	2.00%
Insoluble in HCl (clay)	3.80%
Hygroscopic water	1.25%
Water combined with clay and organic matter	0.90%

Microscopic examination demonstrated that the plaster was a common building material, not special. The mortar was a mixture of this plaster with crude gypsum fragments and fine grains, a little clayey slime containing lime being added.

The mortar was unaffected by time because in a mild climate the disaggregating action of frost is unknown.—*Stone Trades Journal.*



The Recast Analysis and Its Relation to the Chemistry of Portland Cement*

Part VI—Course of Crystallization Beyond Three-Component System

By Louis A. Dahl
Research Chemist, California Portland Cement Co., Colton, Calif.

UP TO this point the study of the course of crystallization has been confined to the three-component system, $CaO-Al_2O_3-SiO_2$. This system has been chosen because it includes three essential components of portland cement, and because the system has been investigated so thoroughly by Rankin and Wright that it provides a basis for a mathematical study of the problem.

Following the principles laid down by Rankin and Wright in their discussion of crystallization in ternary systems,[3] it has been shown that the order of crystallization, the percentages of solid phases and of melt may be determined from the phase diagram, either graphically or by the method of direct computation. It has been shown that when one of the triangles within the main triangle is considered as a separate and distinct ternary system, it is possible to subdivide the triangle into fields, each of which has its own order of crystallization. It has also been shown that there are general principles governing the percentage of melt which may be applied in deriving equations which may serve as a guide in controlling composition in processes involving the burning of mixtures of raw materials to a temperature of incipient fusion, as in the case of portland cement. It is not possible to apply such conclusions without considering the other components which are generally present in portland cement clinker. It is necessary therefore to inquire into the present state of knowledge of systems in which components are present in addition to the three in the system which has been discussed.

Let us consider the system $CaO-Al_2O_3-Fe_2O_3-SiO_2$, which represents the addition of the component Fe_2O_3 to the system which has been discussed. This is a four-component system, and consequently cannot be represented in a plane triangular diagram. A space diagram is required, as illustrated in Fig. 14. The figure is a tetrahedron, each face representing a three-component system, and each vertex representing one of the four components. The location of compositions in the tetrahedron is quite similar to the location of compositions in the triangular diagram. The $Fe_2O_3-Al_2O_3-SiO_2$ face, for instance, represents zero per cent. CaO. The per cent. of CaO increases in proportion to the distance from this face, until at the CaO point it is 100%. The same plan is followed for the other three components. It is clear that any composition of the four components is represented by a point in the tetrahedron.

Four-Component System

In our study of the ternary system it has been necessary to make use of the boundaries of primary phase regions in following the course of crystallization, and in determining the percentages of melt and of solid phases during the process of crystallization. To describe the course of crystallization, and to make similar computations, for the four-component system, the boundaries of primary phase regions in the four-component system would need to be known, as they are in the ternary system. In the four-component system these boundaries are surfaces, corresponding in meaning to the boundary lines in Figs. 10 and 11. To describe the four-component system as thoroughly as the ternary system $CaO-Al_2O_3-SiO_2$ has been described by Rankin and Wright, the tetrahedron in Fig. 14 would need to be honeycombed with surfaces separating primary phase regions.

If the tetrahedron in Fig. 14 is honeycombed with boundary surfaces, the intersections of these surfaces with the faces of the tetrahedron will correspond to the boundary lines separating primary phase regions in the ternary systems represented by these faces. For instance, the intersections of these surfaces with the base, which is the $CaO-Al_2O_3-SiO_2$ triangle, are the boundary lines separating primary phase regions in the system $CaO-Al_2O_3-SiO_2$, part of which is shown in Figs. 10 and 11. If the four-component system is to be investigated, the boundary lines on the surfaces of the tetrahedron furnish an excellent starting point for the location of boundary surfaces. It may be observed, however, that these boundary lines on the surfaces of the tetrahedron give no clue as to the directions in which the boundary surfaces enter into the interior of the tetrahedron. This situation is similar to that described by Rankin[4] in regard to the relation of the binary systems $CaO-SiO_2$, $CaO-Al_2O_3$ and $Al_2O_3-SiO_2$ to the ternary system $CaO-Al_2O_3-SiO_2$. He says that "the compositions of the binary compounds and quadruple points are given as points on the sides of the ternary diagram. These quadruple points are the starting points of the boundary curves which enter the triangle from the sides, but nothing definite as to the course of these boundary curves can be predicted from the binary systems, except that the direction of falling temperature will be from the sides of the triangle toward the interior."

The work which has been done to locate primary phase regions in the ternary systems which are represented by the faces of

[3] Loc. cit., pages 22-69.
[4] Loc. cit., page 22.

the tetrahedron in Fig. 14 furnishes a starting point for research on the four-component system. So far as we know, no work has been done to establish the location of boundary surfaces in the interior of the tetrahedron. Until that is done, it is impossible to trace the course of crystallization in the four-component system, or to define the limits of fields in which the course of crystallization is the same, as has been done in the case of the ternary system in Fig. 11. In considering portland cement problems involving the four components only a part of the tetrahedron in Fig. 14 is involved, and it would be sufficient to locate boundary surfaces in the portion of the tetrahedron near the CaO vertex; that is, to locate the surfaces representing the boundaries between regions in which portland cement compounds appear as primary phases. These surfaces have not been located. Since the information which is necessary for determining the order of appearance and disappearance of phases is lacking, the present state of knowledge of the reactions occurring in the process of burning portland cement compositions of the four components must be described as being quite incomplete and unsatisfactory.

In the case of the ternary system, it has been shown that quantitative relations may be found by two methods: (1) the graphic method, in which the triangle C_3S-C_2S-C_3A is considered as a separate and distinct ternary system; (2) the purely mathematical method, in which compositions originally expressed in such terms that the oxides are considered as components are recast into terms in which the final products of crystallization are considered as components. It has been found to be an advantage to employ both methods, each serving to explain and amplify the facts and principles learned from the other. When the four-component system is considered, the graphic method becomes difficult because of the necessity of using a space diagram. For five or more components, the graphic method cannot be used at all. It is evident, then, that the mathematical method increases in value as the number of components is increased. It is because of this fact that we have laid such stress upon the mathematical method.

Before attempting to apply the mathematical method to a study of the possibilities in the analysis of systems of more than three components, let us consider the general method of determining the percentage of melt, and the percentage of each of the solid phases in the ternary system. When the composition of the melt is known, the first step is to recast the composition of the mixture, and the composition of the melt, into terms of potential composition. If A, B and C represent the three compounds in the potential composition, then A_s, B_s and C_s may be used to represent percentages of the solid phases, A_p, B_p and C_p to represent the percentages of A, B and C in the potential composition of the mixture, and A_m, B_m and C_m to represent the percentages of A, B and C in the potential composition of the melt. If r is the fractional proportion of melt, then

$$
\begin{aligned}
A_s &= A_p - A_m r \\
B_s &= B_p - B_m r \qquad (19) \\
C_s &= C_p - C_m r
\end{aligned}
$$

When these equations are set up, it may be found that the right-hand members of some of the equations consist of positive terms. These equations do not enter into the determination of the percentage of melt. The remaining equations are equated to zero, and the value of r calculated from each. The least of these values of r is the fractional proportion of melt when equilibrium is attained. When this value of r is applied in the equations, the percentage of each solid phase may be calculated.

Methods May Be Applied to Any Number of Components

It should be observed here that the method of setting up the above equations is based upon principles which are not dependent upon the fact that only three components are under consideration. The method may therefore be applied to any number of components. For instance, if another component is added to the system another compound, which we may call D, is added to the list of

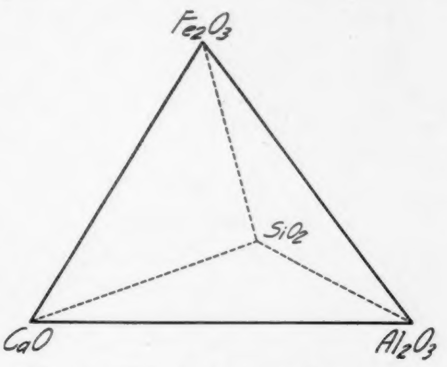


Fig. 14. Tetrahedron used to represent four-component system

components in the potential composition. The equations for the four-component system may then be written:

$$
\begin{aligned}
A_s &= A_p - A_m r \\
B_s &= B_p - B_m r \\
C_s &= C_p - C_m r \\
D_s &= D_p - D_m r
\end{aligned}
$$

These equations can be used to obtain numerical results if the composition of the melt under any specified condition is known. For the three-component system CaO-Al_2O_3-SiO_2 the composition of the melt at each of the intersections of the boundary curves (quintuple points) have been determined by Rankin and Wright. For four or more components such information is not available. It is consequently impossible to present a detailed description of the course of crystallization in the system CaO-Al_2O_3-Fe_2O_3-SiO_2, or in a system in which still other components, present in portland cement clinker, are included.

It is possible, however, to consider the equations in accordance with present ideas as to the compounds which may be present in portland cement clinker, in order to learn whether the conditions governing the percentage of melt at temperatures of incipient fusion are similar to those which are found for the ternary system. For this purpose the system CaO-Al_2O_3-Fe_2O_3-SiO_2-MgO will be considered, and it will be assumed that the final products of crystallization are $3CaO \cdot SiO_2$, $2CaO \cdot SiO_2$, $3CaO \cdot Al_2O_3$, $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$ and MgO. (See note below.) The final products will be designated as C_3S, C_2S, C_3A, C_4AF and M, respectively, in accordance with the system of abbreviation which has been used in the study of the ternary system.

In the ternary system it was found that at comparatively low temperatures at or slightly above the temperature of incipient fusion, such as the points S and T in Fig. 11, the composition of the melt is outside of the C_3S-C_2S-C_3A triangle, so that the melt cannot be considered as being capable of crystallizing alone to form the compounds C_3S, C_2S and C_3A. This is also indicated by the fact that when the equations for calculating potential composition are applied to such melt compositions, negative values are obtained for C_3S. As a result of this condition, the per cent. of C_3S actually present at equilibrium in the presence of such a melt is greater than the potential C_3S by an amount which is proportional to the percentage of melt. There is no field of compositions in the C_3S-C_2S-C_3A triangle in which the percentage of melt is governed by the percentage of potential C_3S. There are such fields, however, for potential C_2S and C_3A, which are the final products of crystallization appearing as positive quantities in the potential composition of the melt. It is of interest therefore to determine whether such conditions exist in the five-component system. By the methods described in Section 1, the equations for calculating potential composition in the five-component system are found to be:

$$
\begin{aligned}
C_3S &= 4.071\ CaO - 1.430\ Fe_2O_3 \\
&\quad - 6.718\ Al_2O_3 - 7.601\ SiO_2 \\
C_2S &= 8.601\ SiO_2 + 1.078\ Fe_2O_3 \\
&\quad + 5.068\ Al_2O_3 - 3.071\ CaO \\
C_3A &= 2.650\ Al_2O_3 - 1.692\ Fe_2O_3 \qquad (20) \\
C_4AF &= 3.043\ Fe_2O_3 \\
M &= MgO
\end{aligned}
$$

The equations for C_4AF and M (MgO) have no negative terms. Negative values for C_4AF and M consequently cannot appear in the potential composition of any melt. This leaves only C_3S, C_2S and C_3A as components which may appear as negative values, as far as can be determined by inspection of the equations for calculating potential composition. Let us consider these separately.

(Note) Calculations of the Compounds in Portland Cement. R. H. Bogue. *Industrial and Engineering Chemistry*, Analytical Edition, 1, 4. Reprinted in ROCK PRODUCTS, November 9, 1929. The X-Ray Method Applied to a Study of the Constitution of Portland Cement. L. T. Brownmiller and R. H. Bogue. Bureau of Standards Journal of Research. Vol. 5, pages 813-830 (1930).

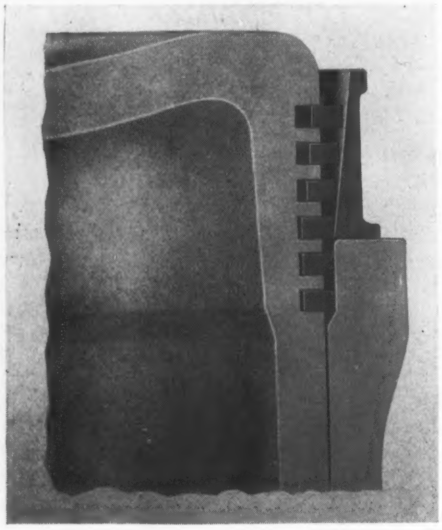
(*To be continued*)

Hints and Helps for Superintendents

Device for Installing Piston Rings

By Orville Adams
Consulting Diesel Engineer, Dallas, Texas

MORE PISTON RINGS break on account of careless installation than for any other reason, it has been found, after careful investigation. Particularly is this



Tapered sleeve forces rings

true in cases of winter overhauling of such machinery as used in the rock products industry. Operators employ several methods of entering the rings in the cylinder, all of which are subject to carelessness and result in breakage, whereas great care is necessary to prevent warping the rings, breaking them and straining them out of true flatness and the like when entering the piston in the cylinder, or when slipping the ring over the grooves.

Sometimes when nothing else is available, the rings are tied down firmly in their grooves by means of copper wire. As the ring enters the cylinder the wire is stripped off and is cut away before it slips up and fouls the wire on the next groove. Operators also use a metal band or sleeve seized with two or more wires twisted tightly around the band to squeeze the rings into the grooves. When the piston is lowered into the cylinder, the metal band is stripped off at the counter-bore of the cylinder when the piston goes in place.

These methods are crude and subject to minor troubles, as well as not being altogether free of breakage. They also require much time. The method illustrated has proved practical and highly satisfactory for cold days when such work must be done with engines and air compressors.

A ring pot or sleeve for this work for each size of cylinder can be made up at a local foundry as illustrated or, instead of a casting, a plate shop can bevel and roll heavy plate which is then welded at the seam to make the tapered sleeve. For large engines it is tapered about 3 in. per ft.

The sleeve is centered to the counter-bore of the cylinder, and the piston is lowered gradually, with a copious amount of lubricating oil or cup grease on the rings and in the grooves of the piston. When the rings are doweled, as for two-cycle engines, the ends of the rings are properly located so they will not foul the dowel pins, and when so placed the piston is lowered. No struggling with the hands, pieces of pipe, wire or rope is necessary. Neither is an uncertain and unsteady thin sleeve of metal around the ring to be slipping and permitting rings to spring out just sufficient to fail to enter the cylinder.

Screen Storage

DELAYS in operation can be very expensive. Occasionally unexpected causes make plant shut-downs unavoidable. To insure against avoidable delays a large stock of repair and replacement parts is kept on hand at the sand and gravel plant at Junction City, Nev., which will supply the Hoover dam. An example of this is the stock of screen cloth and perforated metal. The different sizes are stored in suitable wood racks alongside the crushing plant. Perforations from 9-in. square down to ¼-in. wire cloth are thus kept on hand for future use.

Ample stock of screens prevents unnecessary shutdowns

Kettle Top Insulation

WHERE the so-called extension top has been installed on a gypsum calcining kettle to give it a larger capacity, some saving in fuel consumed can be effected by a study of the heat losses from this top. In most cases this extension top is of sheet iron construction and is not bricked in nor a part of the brick wall. This gives about 150 sq. ft. of unprotected surface from which heat is constantly being radiated. The temperature is comparatively low. The loss is not great, but offers an opportunity to make savings in operating costs.

At the installation shown the top of the kettle brickwork was first insulated by raising the top band 1 in. above the brickwork. The area was then filled in with wet stucco and allowed to set. A second band was put around the top of the metal extension top and this was similarly filled with stucco and

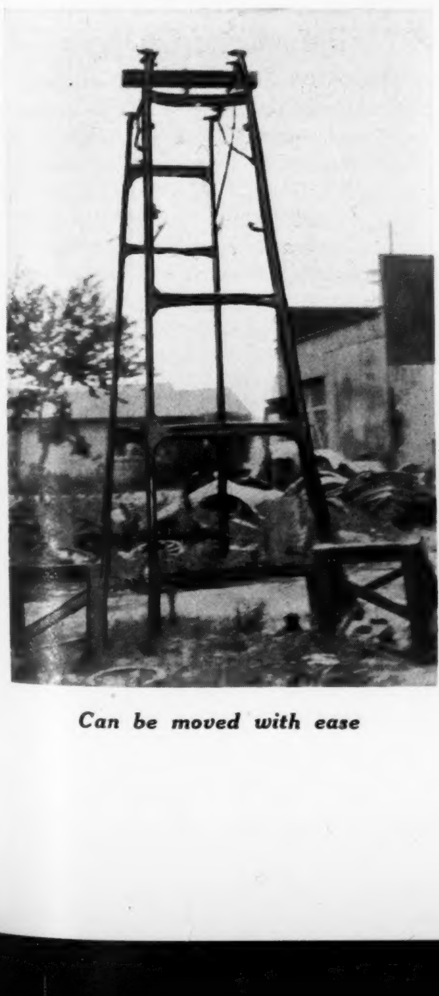
Inexpensive insulation of "extension top" of kettle

allowed to set. Thus the area of exposed surface was greatly reduced at no expense except an hour or two of labor.

Handy and Inexpensive Derrick Has Many Uses

By Dare Paris
Monrovia, Calif.

THE accompanying illustration shows a steel derrick built from frames of motor trucks. The cost is small as all that is required is two frames erected on end and tied together at the top with angle iron. A 6x6-in. timber is placed across the top to carry a set of chain blocks. Such a derrick comes in handy around the plant for repairing trucks, dump cars and other things that come up from time to time.



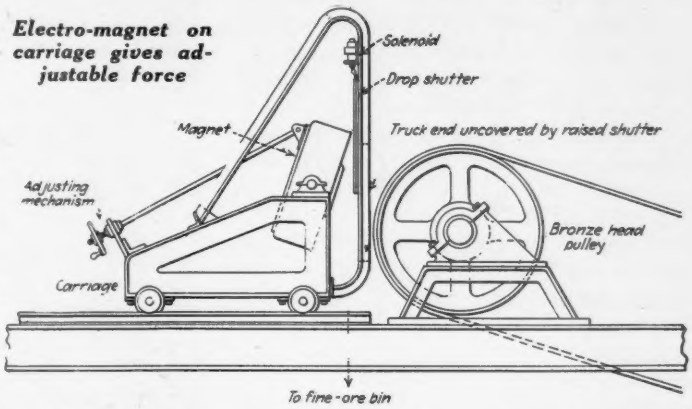
Can be moved with ease

Device Removes Metal

A DEVICE by which tramp iron and steel are removed from ore before milling is in use at the plant of a company in South Africa. It might prove of value in various rock products plants to protect grinding equipment from pieces of metal which may become mixed with the product under preparation. At the plant in which this device is used 50 tons of scrap are removed annually.

This device, which was described in the *Engineering and Mining Journal,* consists of an electromagnet mounted on a movable truck, as shown in the accompanying sketch, and placed at the discharge end of the belt conveyor that delivers ore to the battery bin.

Electro-magnet on carriage gives adjustable force



Design of the device permits the face of the magnet and the end of the truck uncovered by a drop shutter to be adjusted to the stream of ore. The shutter falls when the current passing through the coils of the magnet solenoid is interrupted, thus preventing metal scrap from falling into the ore bin. Residual magnetism in the magnet is sufficient to hold the scrap for about ten seconds, whereas the shutter acts simultaneously. At intervals of 24 hours the truck and magnet are backed away from the conveyor, the current is interrupted, and the load of metal, weighing about 300 lb., is released, to be sent to the foundry for use as casting metal.

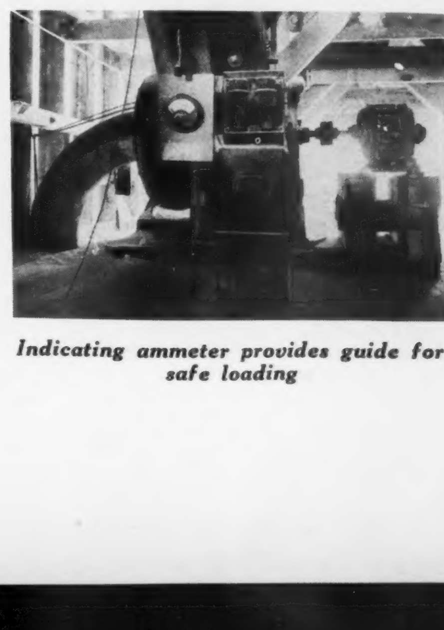
The magnet has an over-all diameter of 36 in. and a center pole of 12 in. Lifting capacity is 3 tons or more of solid iron and steel on contact with the pole piece, and about 1000 lb. of tramp iron. Total weight of the device is 2100 lb. Cooling water for the magnet is furnished by a small motor-driven pump, and direct current at 90 volts for excitation is generated by a motor-generator set, equipped with a drum-type controller, switch gears, and control meters. About 4000 lb. of scrap metal is removed each month from the 70,000 tons of ore milled in that period. Economies effected by the device repaid its initial cost in a few months.

Ammeter Warns of Fast Loading of Gypsum Kettle

STICKING A KETTLE in a gypsum plant has become a rare occurrence, as the newer plants have been designed to take care of such emergencies in one way or another. However, now and then a kettle is stuck even in the best managed mills with a loss in time, material and a general demoralization of the operation that far exceeds the cost of the ammeter used at a western gypsum plant to prevent it. Such an installation may be quickly and easily made for any kettle.

A large percentage of stuck kettles are due to green operators who load the kettle too fast, thus overloading the equipment. To make it possible for the new operator to know exactly what load was being carried on the motor driving the kettle at this plant a General Electric indicating ammeter was installed on each kettle. Instructions then only had to be given not to allow the amperage to go above a certain figure, as the high amperage naturally indicated a higher load.

The cost of installation is small compared to the sum of the losses from a single stuck kettle.



Indicating ammeter provides guide for safe loading

Rock Products Clinic

Getting Rid of Excess Fines in Sand

THE EDITOR: I noticed in ROCK PRODUCTS, of May 21, 1932, the correspondence between Edmund Shaw and the superintendent of a sand and gravel plant in which I am interested. I am not sure that Mr. Shaw was thanked for his courtesy and promptness in replying to the inquiries, for the soundness of his advice, and the assistance gotten from it, and from his book, "Sand Settling and Devices for Settling and Classifying Sands." If not, I extend my thanks now and assure him of our appreciation.

It was impracticable with the plant arrangement to install the dewatering box suggested, but a sand box larger than the original that was being used was put in as Mr. Shaw advised. Experiments were then carried on until finally a double box was evolved.

The excess of fines, which Mr. Shaw so correctly diagnosed as the trouble, persisted but finally was conquered by the addition of extra water through a 3-in. perforated pipe across the box.

For a time, only one box was used, but later the second or "dead box" was equipped with a baffle and water pipe, and the two boxes gave a very satisfactory method of controlling the sand as to fineness.

I imagine that some of the various commercial devices would give greater efficiency but for the present the arrangement is showing good service.

Practically all gravel in our area carries considerable debris, most of which is eliminated with the waste water and by stationary screens; some, however, persists very stubbornly.

I have been very much interested in observing the way the sand flows into a box from the flume. The fine sand seems to drag on the bottom and the coarser above and small pea gravel, a certain per cent. of which goes into concrete sand, would roll on top, exactly reversing the order in which I had conceived it would and should enter. This explains the purpose of some of the tortuous passage devices I have noticed just ahead of sand boxes around here.

However, one successful sand box I noticed had no such device but had the flow discharging against the back of box opposite the spigot and overflow. This box was 6 ft. by 6 ft. by 6 ft., V-shaped with no baffles or water pipe, and cared for an 8-in. sand pump with better results than the average. I believe that the manner in which the flow entered the box had merit in this case and was, in a measure, responsible for the more than usual success of the box.

J. Y. SNYDER.

Oregon Pumicite

THE EDITOR: The article by A. M. Luckey, of Pasadena, Calif., in the issue of ROCK PRODUCTS, July 30, relative to the Fresno County pumicite is of considerable interest. The very lucid picture of the deposit impresses one with its magnitude and importance. This is more readily recognized by the writer, since for years I have been producing lump pumice for Eastern shipments, but of late I have been devoting my time exclusively to a "sand and gravel" deposit of pumice near Chemult, Ore., sizes ranging from 1 in. down to sand. The

Deposit of Oregon pumicite

Southern Pacific main line runs through the center of the 290 acres in cuts showing from 12- to 30-ft. banks of all the same grade and sizes of pumice. Herewith is a view of bank in the railway cut, giving an idea of its magnitude, workability and transportation facilities. The well is 29 ft. to water, all in pumice.

I consider this deposit of pumice and the Fresno deposit of pumicite equally valuable as they each supply different requirements. The Oregon deposit, mine-run, fills the bill for light aggregate in concrete but when screened and sized is ideal for acoustic plaster, and is so recognized.

Berkeley, Calif. W. A. T. AGARD.

Herr Tippmann's Views Appear Discredited

THE EDITOR: In No. 6 of your periodical ROCK PRODUCTS, of March 26, 1932, I find on p. 52 a report of the work of Mr. Tippmann concerning the hardening of portland cement.

You will permit me most kindly to call your attention to this; that these views of Mr. Tippmann are in no case shared by the experts in Germany, but that these views have met with active opposition. I would appreciate it if you would have the kindness to call the attention of your readers to this. You will find the discussions which I have made in this matter in the periodical *Zement*, 1931, No. 11, p. 234, and No. 40, p. 887.

Besides me, Dr. Dorsch has also put himself on record against the views of Mr. Tippmann. You will find the remarks of Dr. Dorsch in the periodical *Zement*, 1931, No. 13, p. 296.

If it is more convenient to you to read the discussion in the English language, I refer you to the periodical *Cement and Cement Manufacture*, where you will find a detailed reference in Vol. 5, No. 1, p. 19, January, 1932.

Finally I need to call your attention to this, that also Mr. Loventhal has refuted the views of Mr. Tippmann in *Cement and Cement Manufacture*, Vol. 5, No. 3, p. 87, March, 1932.

DR. HANS KUHL.

Berlin, Germany.

Dissociation of Gypsum in Presence of Catalysts

DISSOCIATION of $CaSO_4$ at temperatures up to 1200 deg. has been investigated and reported by I. E. Adadurov and V. P. Pligunov. The quantity of SiO_2 used has little effect on the yield of SO_3, an indication that displacement of SO_3 by SiO_2 is not a primary but a secondary reaction. The action of Al_2O_3, Fe_2O_3 and Cr_2O_3 is similar to that of SiO_2. This shows that the above substances have a catalytic and not a chemical effect on the reaction, contrary to the opinion of Terres. Best results were obtained with Cr_2O_3 when decomposition of $CaSO_4$ reached 100% in 1 hr.

Since the heat of activation at 700 to 900 deg. is only 9500 calories per gram molecule, the gypsum must depend on intramolecular rearrangements. At 900 to 1100 deg. the process is catalytic, the degree of decomposition depending on the nature of the catalyst. Calculation of the wave length that the catalyst must be capable of exciting is in striking agreement with the experimental results.—*Chemical Abstracts.*

State Planning Commission Is Proposed by H. V. Owens

PLANS for a State Planning Commission as a governmental unit were announced recently in New York State newspapers by Harold V. Owens, chairman of the executive Board of the New York State Construction Council, Inc., and president of the National Sand and Gravel Association.

The proposed commission, Mr. Owens states, would have the authority for the determination of a sane and far-sighted policy and program of public works construction in the state. The membership of the commission would be free from all political influences and composed of men qualified by education and experience to consider and pass upon the technical, economic and welfare aspects of a state-wide public works policy.

"This is but one of the several principles of the recently incorporated New York State Construction Council which are offered for the mutual benefit of the state and its citizens," said Mr. Owens.

"In addition to urging the State Planning Commission, the Council stands squarely in back of the motoring public in the belief that proceeds from a 2c. per gal. tax on gasoline, plus those from the original motor vehicle tax, are sufficient to meet the expenses of a normal and adequate program of highway construction and reconstruction throughout the state.

"Few persons have realized the tremendous blow suffered by the state's public works program through diversion of motor vehicle and gasoline tax funds at the last session of the legislature.

"Nearly $52,000,000 of revenues dedicated for highway work alone was diverted to the general fund by the legislature. Of this, about $30,000,000 was turned over to the fund in absolute contradiction of provisions of Section 289-D of the Tax Law and Section 73 of the Motor Vehicle Law.

"In theory public works are paid for by the public and are for the public benefit. Public works construction, unless dictated by the needs of public health or other general welfare necessities, should be least active during periods of general business prosperity. It should be most during periods of depression as a medium of unemployment relief and general business stimulation.

"The legislature failed to accept this theory and contributed to unemployment by diverting this huge fund which was, and rightly so, dedicated to a public construction program," said Mr. Owens.

"The Council holds that motor vehicle and motor fuel taxes were conceived and imposed to provide and maintain improved highways for the use of motor vehicles. They are road taxes in improved and equitable form. Since their imposition all expense of constructing and maintaining state and county highways in New York, except amortization of the balance of the original $100,000,000 road bond issues, has been paid out of revenues from these taxes. All state highway expense, including interest and amortization of the old bonds, should be paid from these revenues, absolutely relieving other sources of taxation.

"There is a continued tendency upon the part of the legislature to disregard this principle, and it is the duty of every voter in the state to ascertain how his senator and assemblymen stand on the question of diversion of highway funds and restoration of the 2c. gasoline tax and original motor vehicle fees.

"It is to the best interests of the voter to refuse to support any candidate who does not definitely declare himself against further diversion and who refuses to support the 1929 gasoline tax and registration tax laws. Election is near, the time is short. The voters of the state should rebuke those legislators who have supported illegal diversion of dedicated revenues and who refused to acknowledge the fairness of a 2c. gasoline tax by leaning toward increasing the present emergency 3c. rate. The Council believes that the legislature should be impressed and warned against repetition of its mistakes of the last session and asks the support of the state's 13,000,000 citizens in this move."

H. V. Owens

Local Engineers to Advise About R. F. C. Loans

THIRTY-SEVEN ENGINEERS have been invited by the Reconstruction Finance Corp. to serve in advisory capacities in connection with applications for loans on self-liquidating construction projects.

These engineers will be members of the advisory committees of the corporation's loan agencies, and will sit with those committees, when self-liquidating loans are being considered. It is the hope of the directors of the corporation that the advice and counsel of these engineers will be of great help to applicants for small loans.

The names of the engineers, with the loan agencies on the advistory committees of which they will serve, are as follows:

F. H. McDonald, Atlanta; Oscar G. Thurlow Birmingham; William S. Lee, Charlotte, N. C.; Alonzo J. Hammond and Will J. Sando, Chicago; John B. Hawley, Fort Worth (Dallas); Edward N. Noyes, Dallas; Herbert S. Crocker, Denver; Clarence W. Hubbell, Detroit; Francis A. Thompson, Butte (Helena).

Robert J. Cummins, Houston; Gilbert A. Youngberg, Jacksonville; Edward M. Stayton, Kansas City; Don A. MacCrea, Little Rock; Arthur S. Bent, H. T. Cory, Los Angeles; Bennett M. Brigman, Louisville; Francis C. Shenehon, Walter H. Wheeler, Minneapolis; Arthur J. Dyer, Nashville.

John P. Hogan, George W. Fuller, Francis Blossom, New York; Everett E. Adams, Omaha; James W. Follin, Philadelphia; D. C. Henny, Portland; Allen J. Saville, Richmond; W. D. Beers, Salt Lake City.

John D. Galloway, Walter LeRoy Huber, San Francisco; W. D. Shannon, Seattle; John B. Fisken, Spokane; Baxter L. Brown, St. Louis; J. P. Hallihan, Detroit; C. E. Mickey, Lincoln, Neb. (Omaha); Dr. Robt. Heywood, Philadelphia, and Joseph Jacobs, Seattle.

Research Activities of the A. S. T. M.

A REVIEW of the research activities of the American Society for Testing Materials is given in the October issue of the *A. S. T. M. Bulletin.* Tests reported on in this review follow:

Cement. Study of Strength Tests and Effect of Temperature of Cement on Use.

Concrete. Studies of Designing and Proportioning Concrete; Studies of Concrete Aggregates; Deleterious Substances in Concrete; Curing of Concrete; Workability of Concrete; Admixtures in Concrete; Elastic Properties of Concrete; Permeability of Concrete; Conditions Affecting Durability of Concrete in Structures; Methods of Analyzing Concrete; Field Tests for Concrete.

Gypsum and Masonry Materials. Properties of Gypsum Fiber Concrete; Weathering Characteristics of Masonry Materials; Consistency of Gypsum Plaster; Time of Set of Gypsum Neat Plaster; Volume Change in Neat Gypsum and Gypsum Fiber Concrete; and Sand Content of Set Gypsum Plaster.

Lime. Determination of Soundness.

Miscellaneous. Study of Very Finely Sized Materials; and A General Study of Methods of Determining Consistency and Plasticity.

Editorial Comment

A Monthly Rock Products

It is presumed that every reader of ROCK PRODUCTS realizes that it costs vastly more to produce this journal than the 25c per copy, or $2 per year he pays for it. The same is true in varying degrees of every modern magazine or business journal. Publishing is in the nature of a public service industry; with the best type of business journal the major emphasis is always on service to the *reader,* and to the industry of which the reader is a representative. By genuine service to its industry a business journal becomes a valuable medium of publicity for those who have machinery and equipment to sell that industry. It is the revenue from this advertising that very largely pays for the book.

To cooperate with its advertisers in an honest and straightforward way to reduce the costs of publication and consequently of advertising, under the present stress of business affairs, without in any way sacrificing the high editorial quality and prestige of ROCK PRODUCTS, it is desirable to publish our journal 13 times a year instead of 26. Therefore, beginning with the January 25, 1933, number, ROCK PRODUCTS will be published *monthly,* except January, 1934, and thereafter, when our Annual Review Issue will be published on the 10th.

In these short-handed and mentally distressing times live-wire business men want business information in the most concise, readable, concentrated form. It is possible to attain this objective more nearly in a monthly than in a fortnightly journal. It will be the editor's aim and constant goal to give his readers every bit as much really helpful, essential information in the monthly issue, as would have been contained in the present two fortnightly issues. There will be no appreciable saving in editorial costs; therefore, we could not fairly or honestly reduce the present subscription price of $2 per year.

As a matter of fact every cent and more that is received from subscribers is paid out by ROCK PRODUCTS for its contributed articles alone. And with the wealth of material we have to draw upon every reader may rest assured that he will get the very cream of all essential information available to help him meet the serious problems of reconstruction and rehabilitation of these industries. We do not look for a sudden, spectacular comeback, but for a steady, perhaps slow but progressive one, with many changes in business setup and many new, and as yet unknown, economies.

When we get back to the rapid tempo of business that will inevitably follow eventually, we expect to expand our own activities accordingly. We have never failed, in recent years, to have *enough* good editorial material to serve our industry with a mighty useful weekly magazine. That will continue to be our ultimate goal, and we have no doubt that sometime the business of our advertisers in this industry will justify such a journal. In the meantime we ask the continued loyal support of our readers; and we pledge them that they will not suffer any lack of essential information regarding progress and development in this industry because of the reduced number of issues.

What Makes Obsolescence?

What changes have taken place in the three years since the winter of 1929 to render plants and organizations in the rock products industry obsolete? What changes will take place in the next three years which will influence rehabilitation in this industry? Surely every reader is vitally interested in intelligent answers to these two general propositions. To attempt to answer them with the help of the aggregate intelligence of the industry the editor will soon mail out his *annual questionnaire* to subscribers of ROCK PRODUCTS. He respectfully asks the kind indulgence of the recipients that our survey may be complete.

Obviously, society and industry are more than ordinarily in a state of flux. Radical readjustments may or may not be required. In this and in every other industry plants will be examined not merely to see if individual pieces of machinery and equipment are obsolete, but whether the plan and arrangement of them can be modernized; whether they were ever best fitted for the work expected of them; whether the advent of new products has limited their useful service, etc. And of equal importance will be analyses of the scheme of business organizations and business methods, for these as well as equipment may become obsolete.

Factors outside of this industry which will vitally affect its future are the untangling of public finances; the prospects for a market for highway construction materials, public works, the place of rock products in new types of building construction; the resumption of railway buying; the trend of prices and wages, etc. Are we, as some economists believe, on a long cycle of declining or continued low prices, measured in dollars?—that is, in dollars of high purchasing power? Would all our troubles be cured, as some think, merely by price increases, permitting a margin of profit at present dollar values? Or does the solution of making a profit lie in still further reducing costs to present or higher dollar values? Is it the price of cement, lime, stone or what not that fluctuates; or is it the value of currency that changes and upsets our economic structure?

The future of industry, and business in general, depends a great deal on our business and industrial philosophy of the next few years. There have been many conflicting and perplexing theories and ideas thrown about since the recent depression, but business men are beginning to organize and analyze their experience and thoughts. May we have some of these to summarize in the annual review issue of ROCK PRODUCTS, December 31, 1932?

The Federal Specifications Board invites criticism of its recently adopted aggregate specifications (ROCK PRODUCTS, October 8, pp. 17-18), which shows a disposition to be fair to the producers.

Federal Aggregate Specifications

A study of the specifications leads one to believe that the Board had this fairness in mind in drawing all the sections. With perhaps one exception, the sand grading requirement, there seems to be nothing in the specifications that would work hardship to any great number of producers, although individuals will be found who will object to some things that are hard for them, either from the nature of their deposits or because changes in the plants might be required. This would be the case with any specification. In the main, however, the specifications are such that a great many aggregate producers will have no serious difficulty in filling them.

Having said so much, it will be well to look at certain features of the specifications to which some producers may reasonably object. One of these is the division of aggregates into *A* and *B* grades by the soundness and the wear tests. The work of Goldbeck and others has shown that the soundness test is unfair to some aggregates, and experience shows that it is not particularly important in some climates. A low percentage of wear is not at all necessary for good concrete-making qualities, as is admitted by the fact that wear is never included in the tests for slag. However, the wear test does bring out structural weakness and it is probably retained for that reason; but if this is so, was it necessary to place the limit of wear so low as 7%?

Fortunately, the Board has provided that proof of satisfactory service, without appreciable disintegration, for five years shall be accepted as sufficient proof of soundness, and this will obviate much of the injustice that might result from grading only by the wear test and the soundness test. This is a fair provision and one that might well be written into other specifications. The writer has known aggregates to be rejected as "probably unsound" by an engineer who was in sight of buildings that had stood not five but 25 years without appreciable disintegration.

In the main the requirements for cleanliness and freedom from deleterious materials do not differ much from those of other specifications calling for first-class materials. The low limit of ¼% on clay balls in coarse aggregate will be really hard for some producers to meet, but it can be met with the proper methods and machinery. The question is, *must* we have such thorough cleaning to secure the required durability and strength? There is so much evidence that we should have it, especially where sections are comparatively thin and where resistance to bending is wanted, that it would be hard for anyone to dispute it.

The requirements just mentioned will affect only a relatively small tonnage of the total aggregate production, but the grading requirements are bound to affect practically all producers, either from the nature of the deposit or the design and condition of the plant.

One requirement which will be impossible for a great many producers of sand to fill is that which says at least 10% of the sand shall pass No. 50 sieve and be retained on No. 100 sieve. In studying this section the writer analyzed a report of the New York state geologist on the sand and gravel deposits of that state. This contained 51 sieve analyses of deposits from all parts of the state, including the heavy tonnage producers of the Long Island shore. Of the 51, only 24 (47%) had more than 10% of the 50- to 100-mesh grains, and the range was from 11% to 20.4%, the average being 14.9%. If sands with only 11% or 12% of 50- to 100-mesh grains also contain much clay so that they have to be well washed it is practically certain that the washed sand would contain less than the 10% required, unless a considerable cut was made from the coarse end or the middle. Such cutting is expensive and the chances are that it would throw the grading off for some of the other requirements. Some deposits along the Atlantic coast and some of the river deposits of the Mississippi valley are in this same condition.

Recent research, so recent that little of it has been published yet, has established that most natural sands are deficient in the 50- to 100-mesh grains and that greater strength and workability may be secured by adding these grains. The addition of 50- to 100-mesh sand to bring these grains to 17% in some cases has given the same strength and workability as was given by increasing the cement about 15%. In some parts of the country a regular trade in supplying fine sand to use with ordinary concrete sand has sprung up, and silica sand producers on the Pacific coast have discovered that this use furnishes a real new market.

The necessity for so much fines for the best concrete was pointed out by Graf and Merckle some years ago, as quoted by Gonnerman in his well-known paper on fine aggregates. The Joint Committee of 1924 evidently knew of the value of these 50- to 100-mesh grains, because it placed the low limit at 10%. But state highway departments are nearer to the producers, and of the 18 that set a low limit on this size, 15 set it at 5% and only three at 10%. The A. S. T. M. specification C33-28T put the low limit at 2%.

There seems to be no doubt that for the best results in workability, strength and impermeability, the 50- to 100-mesh grains should be something between 15% and 20%. This granted, the question is, who shall add these grains where the natural deposits of the locality do not contain them? In the writer's opinion this should be done by the user and not the producer of sand, and such is the custom where fine sands are added as a regular thing.

The coarse aggregate gradings seem fair enough, although there may be some gravel producers who would like to see more pea gravel admitted, as much, say, as is permitted in some gradings by A. S. T. M. C33-26T. But this, perhaps, was more generous in that way than was for the best interests of the concrete industry.

It is to be hoped that every producer will study these specifications carefully and write the Board if he finds anything in them to which he can reasonably object. The specifications are of the greatest importance because they will be used as a model for similar specifications throughout the country. And every producer who objects to anything in them should write, for the Board will be influenced by the number quite as much as by the character of the objections that are received.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	*Dividend
Allentown P. C. 1st 6's[27]	11- 1-32	No market		
Alpha P. C. com.[2]	10-29-32	7¼	8	25c qu. Apr. 25
Alpha P. C. pfd.[2]	10-29-32	60	85	1.75 qu. Sept. 15
Amalgamated Phos. 6's, '36[19]	10-28-32	91	....	
American Aggregates com.[19]	10-28-32	1	3	
American Aggregates pfd.[19]	10-28-32	5	15	1.75 qu. Jan. 1
American Aggregate 6's w.w.[19]	10-28-32	37	42	
American Aggregates 6's ex-w.[19]	10-28-32	35	40	
Amer. L. & S. 1st 7's[27]	11- 1-32	45	....	
Arundel Corp. com.	10-31-32	19 actual sale		75c qu. Oct. 1
Bessemer L. & C. Class A[4]	10-28-32	....	2	
Bessemer L. & C. 1st 6½'s[4]	10-28-32	....	23½	
Bessemer L. & C. cert. of dep.[4]	10-28-32	....	21	
Bloomington Limestone 6's[27]	11- 1-32	No market		
Boston S. & G. new com.[37]	10-31-32	2½	5	5c qu. July 1
Boston S. & G. new 7% pfd.[37]	10-31-32	17	25	87½c qu. Oct. 1
Boston S. & G. 7's, 1934[19]	10-28-32	50	57	
California Art Tile, A	10-27-32	1½	4¼	
California Art Tile, B[9]	10-27-32	....	4	
Calaveras Cement com.	10-27-32	1	2¼	
Calaveras Cement 7% pfd.	10-27-32	....	50	1.75 qu. Oct. 15
Canada Cement com.	10-31-32	4	....	
Canada Cement pfd.	10-31-32	26	27	1.62½ qu. June 30
Canada Cement 5½'s[34]	10-28-32	78	79	
Canada Crushed Stone bonds[34]	10-31-32	50	60	
Canada Crushed Stone com.[42]	10-31-32	1	....	
Certainteed Products com.	10-31-32	1½	2¼	
Certainteed Products pfd.	10-31-32	7	7½	1.75 qu. Jan. 1
Certainteed Products 5½'s	10-31-32	39⅞ actual sale		
Cleveland Quarries	10-31-32	....	30	10c qu. Sept. 1
Consol. Cement 1st 6½'s, A[44]	11- 1-32	4	7	
Consol. Cement pfd.[27]	11- 1-32	No market		
Consolidated Oka Sand and Gravel (Canada) 6½'s[12]	10-28-32	50	....	
Consolidated Oka Sand and Gravel (Canada) pfd.[42]	10-31-32	....	50	
Consol. Rock Prod. com.[35]	10-27-32	10c	25c	
Consol. Rock Prod. pfd.[35]	10-27-32	50c	1	
Consol. Rock Products units[35]	10-27-32	1	2	
Consol. S. & G. pfd. (Can.)	10-31-32	....	50	50c qu. Nov. 15
Construction Mat. com.	10-31-32	¼	1½	
Construction Mat. pfd.	10-31-32	1	4½	
Consumers Rock and Gravel, 1st Mtg. 6's, 1948[35]	10-27-32	36	40	
†Coosa P. C. 1st 6's[23]	10-28-32	15	....	
Coplay Cem. Mfg. pfd.[47]	11- 1-32	8	10	
Coplay Cem. Mfg. 6's, 1941[47]	11- 1-32	55	60	
Dewey P. C. com.[47]	11- 1-32	65	70	
Dolese and Shepard	10-31-32	11	13	$1 qu. Jan. 1
Dufferin Pav. & Cr. Stone pfd.	10-31-32	....	25	1.75 qu. Apr. 1
Dufferin Pav. & Cr. Stone com.	10-31-32	....	4	
Edison P. C. com.[47]	11- 1-32	3	5	
Edison P. C. pfd.[47]	11- 1-32	5	10	
Federal P. C. 6½'s[47]	11- 1-32	55	60	
Giant P. C. com.[2]	10-29-32	2	5	
Giant P. C. pfd.[2]	10-29-32	4	10	
Gyp. Lime & Alabastine, Ltd.	10-31-32	2½	2¾	
Gyp. Lime & Alabastine 5½'s[34]	10-28-32	44	47	
Hermitage Cement com.[11]	10-29-32	3	5	
Hermitage Cement pfd.[11]	10-29-32	15	20	
Ideal Cement 5's, 1943[29]	10-29-32	85	89	
Ideal Cement com.	10-31-32	14	17	25c qu. Oct. 1
Indiana Limestone 6's	10-28-32	11	16	
International Cem. com.	10-31-32	8½	9	50c qu. Mar. 31
International Cem. bonds, 5's	10-31-32	63½ actual sale		Semi-ann. int.
Kelley Island L. & T.	10-31-32	9¾	10	25c qu. Oct. 1
Ky. Cons. Stone com.[45]	10-27-32	1	2	
Ky. Cons. Stone 7% pfd.[45]	10-27-32	10	15	
Ky. Cons. Stone 1st Mtg. 6½'s[45]	10-27-32	15	18	
Ky. Cons. St. V. T. C.[45]	10-27-32	1	2	
Ky. Rock Asphalt com.	10-31-32	¾	1⅓	
Ky. Rock Asphalt pfd.[11]	10-29-32	25	30	
Ky. Rock Asphalt 6½'s	10-31-32	57	62½	
Lawrence P. C.[2]	10-29-32	5	10	
Lawrence P. C. 5½'s, 1942[2]	10-29-32	33	....	
Lehigh P. C. com.	10-31-32	6	8	
Lehigh P. C. pfd.	10-31-32	55	65	1.75 qu. Oct. 1
Louisville Cement[7]	10-27-32	60	80	
Lyman-Richey 1st 6's, 1935[13]	10-28-32	85	95	
Marbelite Corp. com.[35] (cement products)	10-27-32	3c	30c	
Marbelite Corp. pfd.[35]	10-27-32	50c	....	
Marquette Cement com.[47]	11- 1-32	7	10	
Marquette Cement pfd.[47]	11- 1-32	50	55	1.50 qu. Oct. 1
Marquette Cem. Mfg. 1st 5's, 1936[46]	11- 1-32	70	....	
Marquette Cem. Mfg. 1st 6's, 1936[46]	11- 1-32	75	....	
Material Service Corp.	10-31-32	4	11	
McCrady-Rodgers 7% pfd.[22]	10-27-32	20	30	87½c qu. June 30
McCrady-Rodgers com.[22]	10-27-32	No market		75c qu. Jan. 26
Medusa P. C. pfd.[47]	11- 1-32	40	45	1.50 qu. Apr. 1
Medusa P. C. com.[47]	11- 1-32	6	6¾	
Monarch Cement com.[47]	11- 1-32	50	55	
Michigan L. & C. com.[6]	10-29-32	45	....	
Missouri P. C.	10-31-32	6½	7½	25c qu. Jan. 30
Monolith Portland Midwest[9]	10-27-32	60c	90c	
Monolith P. C. com.[9]	10-27-32	1	1¼	40c s.-a. Jan. 1
Monolith P. C. pfd.[9]	10-27-32	1¼	1½	40c s.-a. Jan. 1
Monolith P. C. units[9]	10-27-32	3½	4¼	
Monolith P. C. 1st Mtg. 6's[9]	10-27-32	35	40	
National Cem. (Can.) 1st 7's[27]	11- 1-32	70	80	
National Gypsum A com.[27]	11- 1-32	2	4	
National Gypsum pfd.[27]	11- 1-32	30	....	1.75 qu. Oct. 1
National Gypsum 6's[3]	11- 1-32	70	73	
National L. & S. 6½'s, 1941[19]	10-28-32	65	70	
Nazareth Cement com.[47]	11- 1-32	4	6	
Nazareth Cement pfd.[47]	11- 1-32	25	30	
Newaygo P. C. 1st 6½'s[27]	10-18-32	80	90	
New England Lime 6's, 1935[14]	10-28-32	8	11	
N. Y. Trap Rock 1st 6's	10-31-32	65 actual sale		
N. Y. Trap Rock 7% pfd.[27]	11- 1-32	....	60	1.75 qu. Oct. 1
North Amer. Cem. 1st 6½'s	10-29-32	19 actual sale		
North Amer. Cem. com.[27]	11- 1-32	No market		
North Amer. Cem. 7% pfd.[27]	11- 1-32	½	....	
North Shore Mat. 1st 6's[15]	11- 1-32	19½	20	
Northwestern States P. C.[47]	11- 1-32	25	28	
Ohio River S. & G. com.	10-31-32	....	5	
Ohio River S. & G. 1st pfd.	10-31-32	....	50	
Ohio River S. & G. 6's[16]	10-29-32	....	40	
Oregon P. C. com.[9]	10-27-32	8	12	
Oregon P. C. pfd.[9]	10-27-32	80	85	
Pacific Coast Aggr. com.[40]	10-27-32	....	½	
Pacific Coast Aggr. pfd.[40]	10-27-32	....	1	
Pacific Coast Aggr. 6½'s, 1944[5]	10-27-32	10	12	
Pacific Coast Aggr. 7's, 1939[5]	10-27-32	2½	4½	
Pacific Coast Cement 6's[5]	10-27-32	40	....	
Pacific P. C. com.	10-27-32	3	....	
Pacific P. C. pfd.[5]	10-27-32	28	30	1.62½ qu. Oct. 5
Pacific P. C. 6's, 1935-36	10-27-32	....	94	
Peerless Cement com.[1]	10-28-32	25c	50c	
Peerless Cement pfd.[1]	10-28-32	6	12	
Penn.-Dixie Cement com.	10-31-32	1	1⅛	
Penn.-Dixie Cement pfd.	10-31-32	2½	7¼	
Penn.-Dixie Cement 6's	10-29-32	41 actual sale		
Penn. Glass Sand Corp. pfd.[27]	11- 1-32	40	50	1.75 qu. Apr. 1
Penn. Glass Sand Corp. 6's[19]	10-28-32	73	80	
Petoskey P. C.	10-31-32	1⅞	2½	
Port Stockton Cem. com.[9]	10-27-32	No market		
Riverside Cement, A[9]	10-27-32	....	5	
Riverside Cement, B[9]	10-27-32	....	1	
Riverside Cement pfd.[9]	10-27-32	47	50	1.50 qu. Nov. 1
Sandusky Cement 6's[10]	10-28-32	75	85	
Sandusky Cement 6½'s, 1932-37[27]	11- 1-32	70	80	
Santa Cruz P. C. com.	10-27-32	.29	65	$1 qu. Oct. 1
Schumacher Wallboard com.	10-27-32	1.10	....	
Schumacher Wallboard pfd.	10-27-32	3.05	....	50c qu. May 15
Signal Mt. P. C. pfd.[47]	11- 1-32	5	8	
Southwestern P. C. units[47]	11- 1-32	135	150	
Southwestern P. C. com.[47]	11- 1-32	20	25	
Southwestern P. C. pfd.[47]	11- 1-32	70	75	$2 qu. July 1
Standard Paving & Mat. (Canada) com.	10-31-32	....	2	
Standard Paving & Mat. pfd.	10-31-32	....	34¾	50c qu. Nov. 15
Superior P. C., A	10-27-32	....	30	27½c mo. Nov. 1
Superior P. C., B	10-27-32	....	8¼	12½c Oct. 20
Trinity P. C. units[47]	11- 1-32	30	35	
Trinity P. C. com.[47]	11- 1-32	5	10	
Trinity P. C. pfd.[47]	11 1-32	28	33	
U. S. Gypsum com.	10-31-32	22¾	23⅝	40c qu. Oct. 1
U. S. Gypsum pfd.	10-31-32	101⅝	....	1.75 qu. Oct. 1
Wabash P. C.[21]	9-16-32	5	9	
Warner Co. com.[16]	10-29-32	2	3	
Warner Co. 1st 7% pfd.[16]	10-29-32	15	25	1.75 qu. Apr. 1
Warner Co. 6's, 1944, w. w.	10-28-32	40	50	
Whitehall Cem. Mfg. com.[47]	11- 1-32	15	20	
Whitehall Cem. Mfg. pfd.[47]	11- 1-32	30	35	
Wiscon. L. & C. 1st 6's, '33[15]	11- 1-32	25	....	
Wolverine P. C. com.	10-31-32	....	2	
Yosemite P. C., A com.[9]	10-27-32	90c	1.10	

*Latest 1932 dividend. †Carrying October 1, 1932, coupon.

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers, Tracy Co., Chicago. [4]Butler, Wick & Co., Youngstown, Ohio. [5]Smith, Camp & Riley, San Francisco, Calif. [6]Frederick H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago, Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central-Republic Bk. & Tr. Co., Chicago. [16]G. M. P. Murphy & Co., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hewitt, Ladin & Co., New York. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simonds & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [23]Howard R. Taylor & Co., Baltimore. [24]Richards & Co., Philadelphia, Penn. [25]Hincks Bros. & Co., Bridgeport, Conn. [26]Bank of Republic, Chicago, Ill. [27]National City Co., Chicago, Ill. [28]Chicago Trust Co., Chicago, Ill. [29]Boettcher-Newton & Co., Denver. [30]Hanson and Hanson New York. [31]S. F. Holzinger & Co., Milwaukee, Wis. [32]Tobey and Kirk, New York. [33]Steiner, Rouse and Co., New York. [34]Jones, Heward & Co., Montreal, Que. [35]Tenney, Williams & Co., Los Angeles, Calif. [36]Stein Bros. & Boyce, Baltimore, Md. [37]Wise, Hobbs & Arnold, Boston. [38]E. W. Hays & Co., Louisville, Ky. [39]Blythe Witter & Co., Chicago, Ill. [40]Martin Judge Co., San Francisco, Calif. [41]A. J. Pattison Jr. & Co. Ltd., Toronto, Canada. [42]Nesbitt, Thomson & Co., Toronto. [44]E. H. Rollins, Chicago. [45]Dunlap, Wakefield & Co., Louisville, Ky. [46]First Union Trust & Savings Bank, Chicago. [47]Anderson Plotz and Co., Chicago, Ill. [48]Hemphill, Noyes and Co., New York City.

Proposed Reorganization of Kentucky Consolidated Stone Co.

THE BOARD OF DIRECTORS of the Kentucky Consolidated Stone Co., Louisville, Ky., has announced that the company would not be able to meet the interest payment due November 1 on its sinking fund gold bonds and is proposing a financial reorganization.

It is stated that for the past two years there has been such a drastic curtailment in purchases of ballast by the railways and in the demand for the company's other products and such a reduction in prices that a large part of the company's working capital has become tied up in delayed collections of apparently good accounts.

The Kentucky Consolidated Stone Co. was organized under the laws of Maryland in May, 1928, with a capital of $1,000,000 of 6½% first mortgage bonds, $600,000 of 7% preferred stock and 100,000 shares of no par common stock. In the past 4½ years, notwithstanding three years' depression, the company not only paid interest on its bonds but redeemed $225,000 of its issued bonds. It paid dividends on its preferred stock until July, 1931, and has redeemed $86,500 of its preferred stock.

The financial reorganization plan proposed is that the security holders deposit their securities with the Fidelity and Columbia Trust Co. of Louisville, Ky., and take therefor the depository's receipt; that the individuals composing the board of directors be appointed a reorganization committee on behalf of all the security holders to serve without compensation and to use their best efforts to keep all expenses to the minimum, and to act in behalf of security holders when approved by at least five of the eight members of the reorganization committee.

It is proposed that the present bonds be exchanged for first mortgage bonds in a new company, due November 1, 1944, and secured by the same properties, but that such bonds be divided into two classes—one-half being coupon bonds entitled to interest at the rate of 6% per annum, and the other being registered income bonds entitled to interest at the rate of 6% per annum, whenever earnings are available in the discretion of the board of directors; that after payment of interest on both classes of these bonds the company shall set aside not less than 33⅓% of its net income each year for the redemption and retirement first of the coupon bonds and then of the registered bonds, before any dividend shall be paid upon the proposed new preferred stock, and that all such new bonds shall be callable, in the discretion of the board of directors, at any interest period, on 30 days' notice, at par, and/or the sinking fund may be used to purchase such bonds on the open market at less than par, by the trustee, with the approval of the board of directors.

It is further proposed that when this reorganization plan is declared effective, the company shall pay the interest due as of November 1, 1932, upon the proposed new coupon bonds.

The preferred stock of the present company is to be turned in for 6% preferred stock in the new company, share for share and pro rata, among those preferred stockholders who unite in the reorganization, upon the payment of $5 per share, and also the no-par common shares shall be represented share for share and pro rata among those common stockholders who unite in the reorganization, by a similar class of stock in the new proposed company upon paying at the rate of $5 for each 100 shares thereof.

The balance sheet of the company as of September 30, 1932, is given as follows:

ASSETS	
Current	
Cash	$ 6,532.91
Bills receivable	7,221.98
Accounts receivable	128,072.69
Unexpired insurance premiums	5,513.61
Inventories	29,037.34
Total current	$ 176,378.53
Sinking funds	$ 341.02
Other assets	3,450.21
Mineral lands and deposits (by appraisal)	3,197,888.42
Fixed assets (by appraisal)	1,364 771.32
Deferred	130,023.87
Development	507,730.41
Total assets	$5,380,583.78
LIABILITIES	
Current	
Notes payable	$ 11,964.80
Accounts payable	66,235.39
Accrued interest on bonds, etc.	23,110.29
Total current	$ 101,310.48
Fixed (bonds)	775,000.00
Reserves	
Depreciation	526,630.24
Depletion	116,299.45
Development	72,771.55
	$ 715,701.24
Nominal	
Capital stock, preferred	513,500.00
Common stock and surplus	
Surplus by appraisal	3,187,347.63
Undivided profits	87,724.43
	$3,788,572.06
Total liabilities	$5,380,583.78

Recent Dividends Announced

Consolidated Sand and Gravel pfd. (Can.) (qu.)	$0.50, Nov. 15
Standard Paving and Materials, Ltd., pfd. (qu.)	0.50, Nov. 15

Pennsylvania-Dixie Cement

SUPPLEMENTING the statement of earnings in ROCK PRODUCTS, October 22, p. 27, the Pennsylvania-Dixie Cement Corp., New York City, reports comparative consolidated income accounts for the 12 months ending September 30, as follows:

The consolidated balance sheet of Pennsylvania-Dixie Cement Corp. and subsidiaries as of September 30, 1932, follows:

	1932	1931
ASSETS		
*Land, buildings, machinery and equipment	$22,290,600	$23,345,854
Cash	2,443,183	2,785,842
Short-term securities	170,000	370,000
Notes and accounts receivable	656,907	734,024
Inventories	1,840,254	2,337,889
Miscellaneous investments	64,933	340,721
Cash with trustees	510	510
Insurance fund	....	195,261
Deferred charges	15,413	23,087
Total	$27,481,800	$30,133,188
LIABILITIES		
Preferred stock	$13,098,800	$13,588,800
†Common stock	4,000,000	4,000,000
Gold bonds	9,676,000	10,281,000
Accounts payable	138,916	160,442
Accrued taxes, interest, etc.	107,911	148,018
Federal tax reserve	....	48,898
Other reserves	196,590	376,936
Surplus	263,583	1,529,094
Total	$27,481,800	$30,133,188

*After depreciation and depletion.
†Represented by 400,000 no-par shares.

Signal Mountain Issues Bonds

A DEED OF TRUST empowering the Signal Mountain Portland Cement Co., Chattanooga, Tenn., to issue bonds up to the sum of $750,000 was probated with the Hamilton county register October 19.

A supplemental mortgage in the sum of $220,500, executed to the Harris Trust and Savings Bank, of Chicago, and Harold Eckhart, as trustees, was the first amount levied against the prospective bond issue. Sherman Beck, president of the Title Guaranty and Trust Co., which guaranteed the deed of trust, explained that the supplemental mortgage was for the purpose of retiring all existing obligations of the company, which is a Delaware corporation doing business in Hamilton county.—*Chattanooga* (Tenn.) *Times.*

North American Cement

THE North American Cement Corp., New York City, for the 12 months ended September 30, 1932, reports net loss of $869,873, after taxes, depreciation, depletion, interest and amortization. In the 12 months ended June 30, 1932, the net loss was $675,488.

Reduces Number of Directors

AT A RECENT stockholders' meeting of the Ruhm Phosphate and Chemical Co., Chicago, Ill., the number of directors was reduced to three. These directors are R. P. Hoover, H. E. Hoover and John Ruhm, Jr.

CONSOLIDATED INCOME ACCOUNTS, PENNSYLVANIA-DIXIE CEMENT CORP.
(Years ended September 30)

	1932	1931	1930	1929
Operating profit	$ 329,453	$ 895,392	$2,552,762	$2,930,414
Depreciation and depletion	1,380,844	1,388,425	1,386,517	1,397,257
Loss	$1,051,391	$ 493,033	*$1,166,245	*$1,533,157
Interest	598,473	637,209	681,369	710,980
Federal taxes	....	19,446	67,684	136,105
Net loss	$1,649,864	$1,149,688	†$417,192	†$686,072

*Profit. †Net profit.

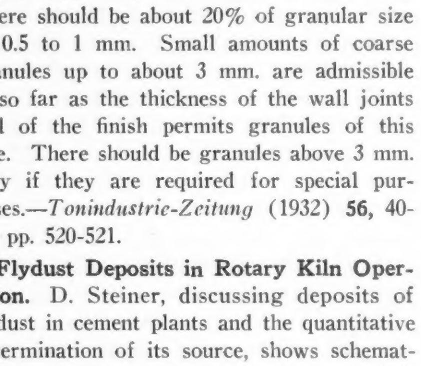
Foreign Abstracts and Patent Review

Specifications for Masonry and Finishing Sands. H. Burchartz states that while quality specifications have been provided in Germany for sand used as aggregate in concrete or reinforced concrete, no uniform requirements exist for sand for masonry and finishing work. Purity and granular size are the deciding factors. In order to determine how sands for use in masonry and finishing work are constituted, the Union of Sand and Gravel Plants of Germany supplied sands from its various sources for testing as to mineralogical composition, color, granular shape and surface condition, weight and density relation, content of elutriable constituents and granular composition.

The following requirements should be required of usable sands. The sand must not consist of rock in a state of weathering, must not be micaceous, and must not contain any organic impurities. The content of elutriables, that is, loamy, clayey, earthy and similar substances, must not be over 3% for masonry sands, and not over 1% for finishing sands.

The sand should have a density of about 0.70, and up to 80% should consist of so-called base material of 0 to 0.5 mm. size. There should be about 20% of granular size of 0.5 to 1 mm. Small amounts of coarse granules up to about 3 mm. are admissible in so far as the thickness of the wall joints and of the finish permits granules of this size. There should be granules above 3 mm. only if they are required for special purposes.—*Tonindustrie-Zeitung* (1932) **56,** 40-41, pp. 520-521.

Flydust Deposits in Rotary Kiln Operation. D. Steiner, discussing deposits of flydust in cement plants and the quantitative determination of its source, shows schematically a complete rotary kiln system, including dust eliminator. The draft prevailing in the various parts of the plant is indicated beneath the schematic illustration. This



1, Kiln inlet; 2, dust chamber; 3, screw; 4, superheater; 5, boiler; 6, economizer; 7, screw; 8, draft fan; 9, collecting chamber; 10, dust eliminator; 11, collecting chamber; and 12, chimney base

plant consists of six rotary kilns, four waste-heat boilers, two large Oski (electrical precipitation) dust eliminating units with three chambers each. In normal operation 470,000 cu. m. of smoke gas at 170 deg. C., containing about 5% of dust per cu. m., passes per hour from the kiln through the Oski precipitator, which accumulates 50 to 60 tons of dust per day, or 5 to 6% of the entire clinker production. A systematic chemical analysis was made of the flydust, samples being obtained at various points in the entire cement plant during shutdown, and the analysis is presented in a table. The fineness of the dust was also examined. The author shows how the data are analyzed so that the sources of the various constituents of the dust can be determined as well as the amount of dust obtained from each source.—*Zement* (1932) **21,** 18, pp. 255-257.

Colored Lime. The Stettin Portland Cement plant, Stettin, Germany, which is the oldest cement plant in continental Europe, has for some years produced a hydraulic building lime. In this process considerable lime dust accumulates, for which no suitable use could be found and which was therefore added to the lime intended for masonry purposes. The extraordinary fineness and the very large volume of this lime dust led to a series of systematic experiments in order to utilize these extremely valuable properties better than is done in the masonry mortar, for here the extreme fineness of the lime and the small volume weight are of no special importance.

In the course of the experiments it was found that this lime dust possessed to an outstanding degree the properties of a base. (It should be mentioned here that in the production of color lakes, an exceedingly finely divided and porous bearing substance, usually aluminum hydroxide, plays the part of a base.) Further experiments led finally to a regular production of colored limes which are offered to the trade in six standard colors, namely, gray, yellow, red, violet, brown, green, as a "refined colored finishing lime."

The color, naturally, is produced only with the use of such coloring substances as are lime-fast and light-fast, so that the colored limes are color-fast as far as that is possible with the present state of science and engineering. This color lime is worked like the ordinary lime mortar. The cheaper grades of colors can be applied directly to the walls as rough or smooth finish, but in case of the more expensive grades a sub-finish of lime or cement mortar is applied or sprayed on.

Owing to its large volume, the color lime is very productive, 45 kg. (990 lb.) mortar produced by mixing 100 kg. (220 lb.) color lime with 350 kg. (770 lb.) pit-moist sand (the sand should not contain very much lime), covers an area of 85 to 100 sq. m. (915 to 1076 sq. ft.) when sprayed on, and an area of 17.5 sq. m. (188 sq. ft.) when applied rough to a thickness of 1 cm. (0.3937 in.) The color lime may be used as exterior or interior finish, as, for example, in making colored ceilings, for bases of stair cases, for bathroom walls, etc., and can be finished as a washable surface. The color lime itself appears generally more pale than the produced finish, for the color develops in working the plaster coat. The material develops a strength similar to that of cement.—*Tonindustrie-Zeitung* (1932) **56,** 66, pp. 828.

Concerning the CaO-$2CaO \cdot SiO_2$-CaF_2 System and a Remark Concerning Alit. E. Jaenecke presents this article to clear up the problem of existence of tricalcium silicate. The basic idea of the article is to use a solvent for $CaO \cdot 2CaO \cdot SiO_2$ which will decrease the high fusion temperatures and lead to three-substance mixtures in which the tricalcium silicate, if it really exists, must appear a primary separation. This solvent must not form any combinations or mixed crystals with lime and dicalcium silicate. The entire investigation should be regarded only as a preliminary result. The results of Carlson (Bureau of Standards, 1931, 7, 901) are considered in the conclusions of the author.

It was intended that the establishment of a phase diagram of the system CaO-$2CaO \cdot SiO_2$-CaF_2 should contribute to the explanation of the problem whether $3CaO \cdot SiO_2$ does or does not exist as a compound. But since it was shown by Carlson that the compound $3CaO \cdot SiO_2$ has a lower decomposition temperature, the investigation proved of no value, since the system cannot determine the existence of $3CaO \cdot SiO_2$. The tests were therefore stopped and the results obtained combined into an approximate phase diagram.

A new explanation is presented regarding the formation of mixed crystals in the ternary system CaO-SiO_2-Al_2O_3, these being interpreted as mixed crystals.—*Zement* (1932) **21,** 26, pp. 377-379.

Fine Cement. A. Eiger reports on his investigations of the granulation and strength of cement obtained from a Solo XX mill and from a laboratory mill to follow up an article on fine cement (*Tonindustrie-Zeitung* 1931, No. 100) and supplements his test data with data from other investigators.

He reports the increase of surface area of cement granules produces a proportionate increase in compressive strength only to a certain limit.

The strengths stop increasing when a surface area of 4000 sq. cm. is reached. An optimum of the strength is obtained when all of the cement has hydrated. The economical granulation at which this occurs includes as many granules as possible of 10 or 15 to 40 microns, with as few as possible of 0 to 10. The investigations are being continued.—*Tonindustrie-Zeitung* (1932) **56,** 42, pp. 532-533; 44, 558, pp. 558-560.

Rapid Determination of Hydraulic Factors in Cements and Raw Cement Materials. F. W. Meier states that there is an increasing need in the cement industry for testing methods for the determination of hydraulic factors which will give accurate results in a minimum of time. He reviews means and methods as given in cement literature, and compares them as to their time requirement and effect.

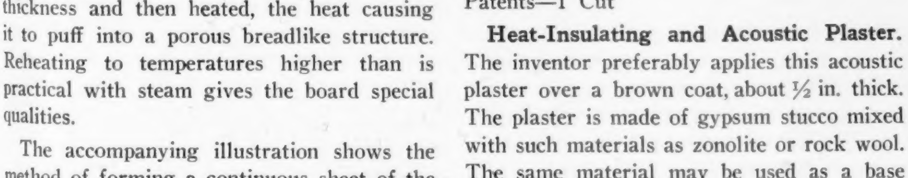
The rapid determination of the hydraulic factors in cement and raw cement material, he suggests, can be carried through simply and accurately by the use of the perchloric acid method for determination of silicic acid, the oxin (hydroxyquinoline) method for determination of the sesquioxides, and the filtration method for determination of the lime. The filtration method also permits the rapid determination of the content in magnesia and SO_3.—*Zement* (1932) **21,** 20, pp. 287-291; 21, pp. 305-308.

Recent Process Patents

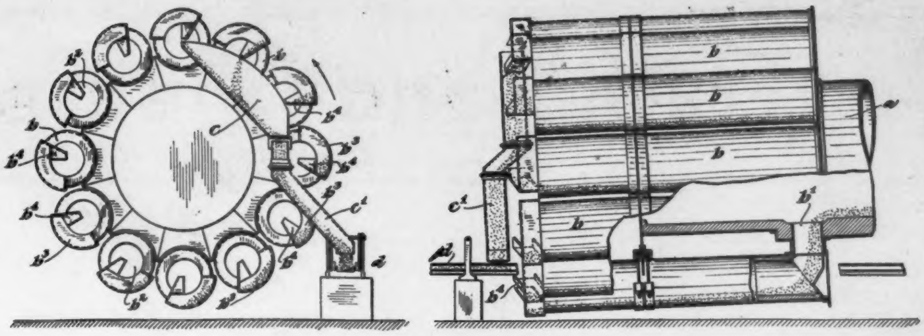
The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Commissioner of Patents, Washington, D. C., for each patent desired.

Machine and Method for Making Wallboard. This is one of a series of patents covering the making of wallboard from a composition of an alkali silicate and a filler. A doughlike mix is made of 1 part sodium silicate and 2 parts of a powdered filler of limestone, dolomite, slate, ashes or something of the kind. This doughlike mix is rolled between two facings to the proper thickness and then heated, the heat causing it to puff into a porous breadlike structure. Reheating to temperatures higher than is practical with steam gives the board special qualities.

The accompanying illustration shows the method of forming a continuous sheet of the mix between two cover papers. This is passed to the puffing chamber (6), where the board passes between heated platens. Then it goes to the hardening chamber (7), where it is kept at 120 deg. C. for not more than 5 min., from which it passes to the heat treatment where it is held at 210 deg. C. for about 20 min. It is then cut into boards.



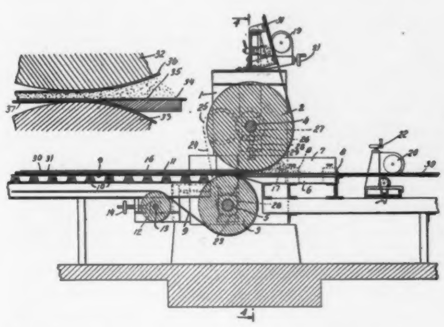
Makes wallboard of alkali silicate and mineral filler



Method of feed and discharge altered

—*Max Kliefoth, assignor to C. F. Burgess Laboratories, Madison, Wis. U. S. Patent No.* 1,829,802.

Plaster Board Machine. In ordinary plaster board making machines, according to the inventor of the device illustrated, the board is always formed between two squeeze rolls and pressure is applied only on the line



Extended plane to make board smooth

where the rolls come in contact with the board. In his machine the board is formed while it is in contact with an extended plane surface which, he says, tends to make a smoother and more uniform board. The process is so clearly shown that a detailed explanation does not seem needed.—*J. J. Turner, assignor to National Gypsum Co., Buffalo, N. Y. U. S. Patent No.* 1,837,381. Patents—1 Cut

Heat-Insulating and Acoustic Plaster. The inventor preferably applies this acoustic plaster over a brown coat, about ½ in. thick. The plaster is made of gypsum stucco mixed with such materials as zonolite or rock wool. The same material may be used as a base coat, in which case it may be finished with lime putty or any other top finishing coat. The surface may be tooled to get a sound absorbing quality. *Gustave New, Assignor to the American Gypsum Co., Port Clinton, Ohio, U. S. Patent No.* 1,839,887.

Rotary Kiln and Cooler. This is an improvement on a well known form of cooler. The patent claims cover the method of feed and discharge. These are so clearly shown by accompanying illustrations that there would seem to be no need of a detailed description.—*L. S. Petersen, assignor to F. L. Smidth and Co., New York. U. S. Patent No.* 1,830,959.

Process for Making Soluble Compounds of Phosphate Rock and Separating Its Contents of Lime and Phosphoric Acid. The inventor treats phosphate rock with nitric acid of less than 80% to form calcium nitrate and free phosphoric acid. The 50% acid made by burning synthetic ammonia and absorbing the nitrogen oxides in water is said to be well adapted to this process. By suitable cooling and the regulation of other conditions at least 80% of the lime present may be crystallized out as $CaNO_3 \cdot 4H_2O$ (with the theoretical water of crystallization). The crystals are separated by filtration or by a centrifugal machine. The mother liquor, which is phosphoric acid with a little calcium nitrate in solution, is said to be particularly well adapted to making compound fertilizer, chemical salts, ammonium phosphates, etc. The patent specification contains several pages describing tests made with phosphate rock and different amounts of acid and different methods of handling.—*Brling Johnson, Assignor to Odda Smelteverke, Odda, Norway. U. S. Patent No.* 1,816,285.

Making a Waterproof Cement. The inventor claims that his process not only makes cement water-repellant but also gives it increased plasticity and sand carrying power. It may be applied to portland cement or a natural cement substantially free from basic oxides. Twenty parts by weight of melted tallow are mixed with 1 part of water and brought to the boiling point of water. Then 60 parts by weight of cement are added and mixed while the temperature is kept at 90 to 100 deg. C. When the cement is added the mixture becomes dry and is dumped and allowed to cool. The inventor claims that there is an actual combination of the fatty acids present, presumably with the alkali or double alkali silicates of the cement, because ether extraction of the mixture fails to show appreciable quantities of any fat or fatty acid.—*Sidney G. Seaton, assignor to Utica Hydraulic Cement Co., Utica, Ill. U. S. Patent No.* 1,855,271.

Traffic and Transportation

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week ending October 15:

TRUNK LINE ASSOCIATION DOCKET

29953. **Sand,** N. O. I. B. N. in O. C., in packages or in bulk, carloads (See Note 2), but not less than 60,000 lb., from Sherks, Ont., to Erie, Penn., $1.50 per net ton. Present rate, sixth class.

29954. **Slag, coated with oil, tar or asphaltum,** carloads (See Note 2), but not less than 90,000 lb. from Sparrows Point (Baltimore), Md., to Towson, Md., $1.10 per net ton. (Present rate $1.25 per net ton.) (See Note 4.)

29955. **Crushed stone, coated with oil, tar or asphaltum,** carloads (See Note 2), from Martinsburg, W. Va., to Marsh Run, Penn., $1.35 per net ton. (Present rate $1.75.) (See Note 4.)

29962. **Sand** other than blast, engine, foundry, molding, glass, silica, quartz or silex, carloads (See Note 2), from Morrisville, Penn., to Eddystone, Penn., and Pottstown, Penn., 90c per net ton (See Note 4).

Sup. 1 to 29922. **Ground limestone,** carloads, minimum weight 50,000 lb., from Grove, Frederick, Keller, Buckeystown, Rosedale, Baltimore, Md., Engle and Martinsburg, W. Va., to Vineland, N. J., 14½c per 100 lb.

Sup. 1 to 29949. **Limestone, crushed,** carloads (See Note 2), from Greer, W. Va., to Mather, Penn., $1 per net ton.

29968. **Ground limestone,** carloads, minimum weight 50,000 lb., from Howe's Cave, N. Y., to B. & M. R. R. stations—Boston, Rutherford Ave., Mass.; Portland, Me.; Worcester, Mass.; Claremont, N. H.; Hoosac Tunnel, Mass.; North Adams, Mass.; South Vernon, Bellows Falls, Windsor, Vt., and various. Rates ranging from 13c to 17c per 100 lb. (See Note 4).

29974. **Ground limestone,** carloads, minimum weight 50,000 lb., from Howes Cave, N. Y., to Catskill Mountain Branch of the N. Y. C. R. R. (formerly U. & D. R. R.), Rondout station, Fleischmann's, Halcottville, Stamford, Kortright station, Hunter, N. Y., and various. Rates ranging from $2.30 to $3.40 per net ton. Reason—Proposed rates are comparable with rates from Jordanville, N. Y.

Sup. 2 to 29922. **Ground limestone,** carloads, minimum weight 50,000 lb., from Cavetown district, viz.: Union Bridge, Cavetown, Security, Pinola, Pinesburg and Charlton to Vineland, N. J., 14½c per 100 lb.

29985. **Sand and gravel,** carloads (See Note 2), from Oaks Corners, N. Y., to Swartwood, N. Y., $1 per net ton. (Present rate, $1.15.) (See Note 4.)

29987. **Crushed stone** (See Note 2), from Casparis, Penn., to Everson, Penn., 50c per net ton, subject to emergency tariff. (Present rate, 60c.) Proposed rate to expire February 10, 1933, and present rate to continue. Reason—Proposed rate is comparable with rate from Dunbar, Penn.

29995. **Crushed stone,** carloads (See Note 2), from Glen Mills, Penn., to Dover, Woodside, Del., $1; Milford, Del., $1.10, and Georgetown, Stockley, Millsboro, Dagsboro and Frankford, Del., $1.20 per net ton. (See Note 4.)

29996. **Limestone, unburned, ground,** carloads, minimum weight 50,000 lb., from Rosendale, N. Y., to points on the Erie R. R., Oxford, Salisbury Mills, Port Jervis, Tuxedo, Blauvelt, Suffern, W. Cornwall, N. Y., and various. Rates ranging from $1.40 to $1.70 per net ton. (See Note 4.)

CENTRAL FREIGHT ASSOCIATION DOCKET

33318. To establish on **sand and gravel,** in bulk, in open top cars, carloads, from Sandyville, O., to Carrollton, O., 80c per net ton, plus emergency charge. Present—200c.

33319. To establish on **crushed stone,** in open top cars, carloads, from McVitty's, O., to Mansfield, O., 80c per net ton, subject to emergency charge. Present—90c per net ton, subject to emergency charge.

33320. To establish on **sand and gravel,** carloads, in open top cars, from Lodi, O., to Valley City, O., 70c; Cleveland, O., 74c per net ton, to expire December 31, 1932, rate of 80c per net ton to become effective January 1, 1933, subject to emergency charge. Present—90c per net ton, subject to emergency charge.

33353. To establish on **crushed stone** or **crushed stone screenings,** in open top cars, carloads, from Bellevue, O., to Harrisville, Maynard, Reiss and Robyville, O., 125c per net ton, subject to emergency charge. Present—150c.

33370. To establish on **sand and gravel,** carloads, from Lafayette, Ind., to Raccoon, Ind., rate of 85c per net ton, plus emergency charge. Present—13c.

33371. To establish on **molding sand,** carloads, from Rynd Farm, Penn., to Oil City and Siverly, Penn., rate of 72c per net ton, plus emergency charge. Present—180c per net ton.

33373. To establish on sand, **blast, core, engine, fire, foundry, glass, molding, quartz, silex or silica,** carloads, from Althom, Penn., to Pepew, Lancaster, North Tonawanda, Niagara Falls and Lockport, N. Y., rate of 189c per gross ton, plus emergency charge. Route—Via P. R. R., Buffalo, N. Y., and connections. Present—16c.

33402. To establish on **slag, crude, granulated, crushed or commercial,** in bulk, in open top equipment, in straight or mixed carloads (See Note 3) from Hamilton, O., to Metamora, Ind., rate of 90c per net ton, plus emergency charge. Present—13c, plus emergency charge.

33408. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) and **gravel,** carloads from Sandusky, O., to points on the N. Y. C. R. R., viz., Huron, 50c; Vermilion, Amherst, 60c; Elyria, Shawville, 70c; Gypsum, Port Clinton, 50c; Oak Harbor, Millbury, Toledo, 60c; Norwalk, Kipton and Oberlin, O., 70c per net ton. Present—60c to Huron; 70c, Vermilion, Amherst; 80c, Elyria, Shawville; 60c, Gypsum, Port Clinton; 70c, Oak Harbor, Millbury; 90c, Toledo; 80c, Norwalk, Kipton and Oberlin, O.

> **Note 1—Minimum weight marked capacity of car.**
>
> **Note 2—Minimum weight 90% of marked capacity of car.**
>
> **Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.**
>
> **Note 4—Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.**

33457. To establish on **stone, crushed; stone screenings; limestone, agricultural, unburned,** in bulk, in open top cars, in straight or mixed carloads, from Gibsonburg and Woodville, O. (rates in cents per net ton):

To	Route	Pres.	Prop.
Albion, Penn.	1	400	200
Cambridge Springs, Penn.	2	420	200
Concord, Penn.	2	440	210
Corry, Penn.	3	440	200
Corry, Penn.	2	440	210
Franklin, Penn.	3	420	180
Franklin, Penn.	2	420	210
Franklin, Penn.	4	420	190
Greenville, Penn.	2	380	190
Greenville, Penn.	1	380	190
Grove City, Penn.	1	420	200
Harrisville, Penn.	1	420	200
Meadville, Penn.	1	420	200
Meadville, Penn.	2	420	200
Pulaski, Penn.	2	380	190
Springboro, Penn.	1	420	200
Sugar Creek, Penn.	2	420	210

Route 1—P. R. R., Shenango, Penn., B. & L. E.
Route 2—P. R. R., Transfer, Penn., Erie R. R.
Route 3—P R. R. direct.
Route 4—P. R. R., Toledo, O., N. Y. C. R. R.

33467. To establish on **crushed stone,** carloads, from Narlo and Maple Grove, O., to Cleveland, O., rate of 60c per net ton. Present, 80c per net ton.

33473. To establish on **crushed stone, crushed stone screenings** and **agricultural limestone** (not ground or pulverized), in bulk, in open top cars, carloads, from Narlo, O., to Titusville, Penn., rate of 190c per net ton, plus emergency charge. Present, 240c per net ton, plus emergency charge, per N. Y. C. & St. L. R. R. Tariff G. F. D. No. 584-H. Route: Via N. Y. C. & St. L. R. R., Dunkirk, N. Y., and N. Y. C. R. R.

WESTERN TRUNK LINE DOCKET

1266-C. Minimum weight: **Stone, broken or crushed,** carloads, from Denver, Colorado Springs, Pueblo, Trinidad Colo., and points taking same rates, to points in Group 7 (Missouri river). Rates—Present and proposed, 25½c per 100 lb. (See Note 3.) In no case shall the minimum weight be less than 40,000 lb. Proposed, 40,000 lb.

6979-D. **Sand, silica; pumice; ash, volcanic** (See Note 1), but not less than 60,000 lb., except where car of less than 60,000 lb. capacity is furnished at carrier's convenience the marked capacity of car will apply, from Reager, Kan., to as shown below. Rates: Present—Calvert, Kan., combination. Proposed—From Reager, Kan., to Chicago, Ill., 23½c; to Peoria, Ill., 23½c; to St. Louis, Mo., Burlington, Ia., 21½c; to St. Paul, Minn., Minneapolis, Minn., 23½c.

ILLINOIS FREIGHT ASSOCIATION DOCKET

6908. **Sand and gravel,** carloads(See Note 1), from East Carondelet (river incline), Ill. Rates per net ton:

To	Pres.	Prop.
Belleville, Ill.	63	55
Coulterville, Ill.	88	80

5596-A. **Stone,** as described in Section 1 of I. C. R. R. Tariff 13321-G, I. C. C. A-10242, from Thornton, Ill., to Rockford, Ill. Rates per net ton. Present, $1.20; proposed, $1.05.

6906. **Gravel and gravel pit strippings** (See Note 3), but not less than 40,000 lb., from Magner, Ill., to points on I. C. R. R. in Illinois. To establish the following rates (in cents per net ton):

To (Rep.)		To (Rep.)	
Waggoner	$1.13	Ospur	$1.26
Pana	1.35	Spaulding	1.10
Dunkel	1.26	Cisco	1.26
Macon	1.20		

6907. **Sand and gravel,** carloads, from Allison Branch, Ill. (rates per net ton):

To (Rep.)	Pres.	Prop.	To (Rep.)	Pres.	Prop.
Hillsboro	*	$1.26	Cairo	*	1.26
Shelbyville	*	1.26	Trimble	*	.98
Mattoon	*	1.26	West Union	*	.98
Forman	*	1.26	Marshall	*	.98
Levings	*	1.26			

*Classification basis.

SOUTHWESTERN FREIGHT BUREAU DOCKET

25812. **Stone, crushed,** from Batesville, Ark., to Chicago, Ill. To establish a rate of $3.50 per ton of 2000 lb. on crushed stone not including gypsum rock, carloads (See Note 3), from Batesville, Ark., to Chicago, Ill. There is a prospective movement of crushed stone from Batesville to Chicago and shipper requests publication of same rate as in effect from southern Arkansas points in Item 3950, S. W. L. Tariff 114E. The distance from Batesville is less than from the southern Arkansas points.

Proposed I. C. C. Decisions

24805. Cement. Oklahoma Portland Cement Co. vs. K. C. S. et al. and a subnumber, Same vs. A. T. & S. F. et al. Dismissal proposed. Rates, cement, Ada, Okla., to destinations in Arkansas and Louisiana, not unreasonable.

24928. Portland Cement. Colorado Portland Cement Co. vs. A. T. & S. F. et al. Rates, portland cement, Portland, Colo., to destinations in Kansas, Oklahoma and New Mexico, unreasonable and unduly prejudicial to the extent they exceed or may exceed those made on the basis of Scale IV, plus the same basis of differentials to destinations west of Clayton, N. M., as applied on traffic from other points in Colorado, Kansas, Oklahoma and Texas. Upon the establishment of rates over the Santa Fe's proposed cut-off, based on the joint shortline distances, the examiner said, the commission should permit the rates over joint routes to be canceled.

25026. Cement. Ash Grove Lime and Portland Cement Co. of Nebraska vs. C. B. & Q. et al. Rates, cement, Louisville, Neb., to points in western Minnesota, North and South Dakota in extended Scale III terri-

tory and to points in North Dakota in extended Scale IV territory, not unreasonable but unduly prejudicial to Louisville and unduly preferential of Mason City, Ia., Duluth, Minn., Steelton, Minn., Hanover and Trident, Mont., and Rapid City, S. D. The examiner said that the undue prejudice should be removed by the establishment of rates for the distances from Louisville computed according to the formula prescribed in Oklahoma Portland Cement Co. vs. D. & R. G. W., 128 I. C. C. 63, the present revised Scale III rates to extended Scale III territory in Minnesota, North Dakota and South Dakota and the present revised Scale IV to extended Scale IV territory in North Dakota, which basis, he said, should be found reasonable for the future. Temporary fourth section relief, he said, should be granted.

I. C. C. Decisions

24394. Crushed Stone. Olive Hill Limestone Co. vs. B. & O. et al. Rates, crushed stone, Atlas, Highland and Limestone, Ky., to destinations in West Virginia, unreasonable to the extent that they exceeded or may exceed, over the shortest route established, rates shown in a table, plus 20c, to destinations on the Ripley and Spencer branches. Rates shown in the table begin with 100c for the block between 40 and 60 mi. become 120c at 100 mi., 140c at 150 mi. and end with 160c a ton for 200 mi. Reparation awarded. New rates to be effective not later than November 3.

24456. Agricultural Lime. Bone Dry Fertilizer Co., Inc., vs. A. C. L. et al. Rates, agricultural lime, Berkeley, W. Va., to Virginia destinations, unreasonable to the extent they exceeded those prescribed in North American Cement Corp. vs. A. & R., 153 I. C. C. 431, 163 I. C. C. 701. Commissioner Mahaffie, dissenting, said the complaint should have been dismissed.

25124. Cement. Dewey Portland Cement Co. vs. A. T. & S. F. et al. Rates, cement, Dewey, Okla., to points in Texas are applicable. Certain applicable rates are unreasonable and complainant found entitled to reparation. Rates charged on shipments to Seagraves between February 25, 1930, and January 11, 1932, inclusive, on shipments to Henderson, Petrolia and Wellington between February 25, 1930, and April 13, 1932, inclusive, and to Cross Plains between February 25, 1930, and May 15, 1932, inclusive, were unreasonable to the extent that they exceeded 30c to Seagraves, 22c to Henderson, 24c to Petrolia, 24.5c to Wellington and 28c to Cross Plains; and that the rates charged on the shipments to Byers and Stamford on and after February 25, 1930, were and are unreasonable to the extent that they exceeded or exceed 23.5 and 27c, respectively. The authorized emergency charge shall be added to the foregoing rates on shipments moving on and after January 4, 1932.

21939. Stone and Gravel. The Interstate Commerce Commission, in a supplemental report by Commissioner Lewis, No. 21939, sand, gravel and crushed stone from Indiana and Illinois points to destinations in Illinois, I. and S. No. 3739, crushed stone from Missouri to Illinois, and I. and S. No. 3746, sand and gravel from Missouri to Thebes, Ill., has found not justified, with exceptions, proposed reduced rates from Cape Girardeau and Marquette, Mo., on crushed stone, to destinations in Illinois on the Missouri-Illinois railroad, and on sand and gravel to Thebes, Ill. Prior findings and orders in the formal complaint case, 181 I. C. C. 373, with respect to rates on crushed stone, from and to the same points, have been modified in part.

The order issued in connection with the report requires the respondents to establish rates on the bases indicated in the findings, to which the emergency charges authorized in the Fifteen Per Cent. Case, 1931, may be added, not later than December 6. The findings follow:

"We find that respondents in I. and S. 3739 and 3746 have not justified the proposed schedules but that they have justified from Cape Girardeau and Marquette, Mo., joint rates to destinations in Illinois on the Missouri-Illinois of 105c as far north as Sparta and 120c north of Sparta to and including Hoyleton, and a joint rate on sand and gravel of 85c over the St. Louis-San Francisco-Chicago and Eastern Illinois route to Thebes, Ill. We further find that the present joint rates on crushed stone from Cape Girardeau and Marquette to Thebes, over the St. Louis-San Francisco-Chicago and Eastern Illinois route, is, and for the future will be, unduly prejudicial to the extent that it is less than 85c. To the rates herein approved are to be added the present authorized emergency charge. The findings in the prior report, 181 I. C. C. 373, are modified accordingly.

24599. Cement. Louisville Cement Co. vs. C. C. C. and St. L. et al. Dismissed. Rates, portland cement, Speeds, Ind., to Brixment, N. Y., not unreasonable or unduly prejudicial.

14349. Ground Limestone Relief. The commission, in fourth section application No. 14349, ground limestone, Falling Spring, Va., to the south, by means of supplemental fourth section order No. 10595, ground limestone, Falling Spring to the south, has granted relief from the long and short haul part of the fourth section in such a way that there is no reference in the order to the equidistance clause, thereby enabling the carriers to establish or maintain grouping from Falling Spring, Va., to all parts of southern territory north of the line of the Seaboard Air Line from Jacksonville to River Junction, Fla., for the considerations stated in Rates on Lumber and Other Forest Products, 165 I. C. C. 561. That is the case in which the relation of the equidistance clause to group adjustments was considered and passed upon in favor of relief for the maintenance of grouping where the relief was not granted "because of such circuity" as was inherent in the longer lines.

The Chesapeake and Ohio for itself and on behalf of other defendants in Falling Spring Lime Co. vs. C. & O., 172 I. C. C. 783, and carriers parties to Glenn's Southern Rate Basis Tariff, I. C. C. A-725, sought authority to establish and maintain rates on ground limestone from Barber, Indian Rock, Eagle Mountain and Rocky Point, Va., to the part of southern classification territory hereinbefore described. In fourth section order No. 10595, division 5 authorized applicants having long lines to establish and maintain rates the same as the direct lines on the basis of the single-and joint-line scales prescribed or approved in that case, subject, among other conditions, to the equidistance provision and to circuity limitations based on the so-called 70 and 50% formula. Short and weak lines were also given relief and authorized to add an arbitrary of 25c a ton for their own benefit, to the junction point or lowest combination rate.

At the request of the carriers the commission reopened the question of the relief granted in fourth section order No. 10595 to consider this request that it be modified in two particulars, first to change the name of "Barber" to "Falling Spring" in accordance with the fact and to restrict the relief to rates from Falling Spring; and, second, to eliminate reference to the equidistance clause from the order, and to authorize relief in connection with rate groups at destinations in the manner authorized by the order of May 4, 1931, in the Falling Spring Lime case.

By fourth section order No. 10671, dated April 4, 1931, as amended, applicants were authorized, according to the report, to establish rates on limestone and related commodities between points in southern territory considered in the southern class rate revision on the basis of distance scales substantially the same as those prescribed in the Falling Spring Lime case. The commission said that that relief included rates from all points named in the instant application except Falling Spring, wherefore this case was limited to rates from that one point.

The commission pointed out that in fourth section order No. 10671 compliance with the equidistance clause was not required, while in No. 10595 that clause was mentioned as a limitation.

Relief was granted on the two points covered by the petition, the rates to be based on a minimum of 60,000 lb., the distances to be computed from Falling Spring to base points in the destination groups instead of to each point in such groups. Changes were also made so as to clarify the relief granted to short and weak lines by eliminating the Gulf, Mobile and Northern, which had been accorded special treatment in the southern class rate revision.

Commissioner Farrell, dissenting in part, said he dissented from the relief granted for the reasons set forth in his dissenting expression in Rates on Lumber and Other Forest Products, supra. He was joined in that dissent by Commissioners McManamy, Lee and Tate.

Approves Increased Cement Rates

THE Southern Pacific Railway has been authorized by the Interstate Commerce Commission to increase rates on portland cement from Monolith, Colton and Crestmore, Calif., to Long Beach and Los Angeles Harbor on shipments destined beyond these ports by water to points on the West Coast.

The rate from Monolith would be increased from 6.5c. to 8c. a 100 lb. and that of 5.5c. from the other two points to 7c.

The commission vacated its order which had suspended these rates upon concluding that the increase was not unreasonable in that it fairly aligns these rates with rates from competing cement plants in California. —*Wall Street Journal* (New York).

Ohio Lime Manufacturers Attack Rates

THE Ohio state corporation commission has taken steps to intervene in an attack before the Interstate Commerce Commission by Ohio lime manufacturers. The state commission will seek to defend the rates from Virginia points.

The complaint claims that Virginia lime in car loadings is given preference over lime shipped from Ohio points.—*Ironton* (Ohio) *Tribune*.

Plan $150,000 Lime Plant in Washington

CONSTRUCTION of lime kilns on the Entiat property of the Superior Lime and Mining Co. will start in the spring, according to J. J. Keegan, who is connected with the firm. Announcement of the organization and preliminary plans of this company was made in the July 4, 1931, issue of ROCK PRODUCTS.

The lime company plans the building of a $150,000 plant and the manufacture of lime as soon as conditions permit. The property has 8,000,000 tons of lime rock in sight, running 95 to 98% calcium carbonate.

Mr. Keegan predicted that hydrated lime could be produced to sell as low as $15 a ton. —*Aberdeen* (Wash.) *World.*

Phosphate in the Tennessee District

WEATHER CONDITIONS have improved recently so that hand miners of phosphate have found it less difficult to operate in the Tennessee area. Most of the lump rock storage which these smaller operators had on hand has been absorbed by the one furnace consumer now buying. Many of these smaller operators have resumed mining. While prices are still below levels at which ordinary wages can be made, there are those who are willing to work at prevailing prices.

The owners of one of the large ground rock plants, with about 1500 acres of property said to contain millions of tons of rock, have offered the property for less than $20,000, without finding buyers, it is reported.

Dedicates Safety Trophy at Independence Plant

DEDICATION of its safety trophy, earned as a result of operation throughout the year of 1931 without an accident, took place at the Independence, Kan., plant of the Universal Atlas Cement Co. on October 18. Several hundred employes and their families, as well as guests representing the various cement mills in eastern Kansas, distinguished citizens of the vicinity and officials of the company, participated in the dedication.

Following an address of welcome by C. M. Carmen, superintendent of the Independence plant, the trophy was presented by A. J. R. Curtis, assistant to the general manager of the Portland Cement Association. The trophy was then unveiled by daughters of Mr. Carmen and accepted by Dave Eifler, chairman of the plant safety committee.

Short addresses were given by R. C. Mitchell, mayor of Independence; W. D. Ryan, safety commissioner, U. S. Bureau of Mines; C. J. Beckman, commissioner of labor, State of Kansas; Gordon C. Huth, safety director, Leonard Wesson, assistant operating manager, and P. C. Van Zandt, vice-president, Universal Atlas Cement Co. These were followed by an address by C. F. Larsen, superintendent of safety, Missouri Pacific railroad.

Refreshments were served by the plant safety committee following the program.

Mrs. Roosevelt Might Make a Good President

MRS. FRANKLIN D. ROOSEVELT, taking the stump upstate for Lieut. Gov. Herbert H. Lehman, Democratic nominee for governor of New York, defended the administrations of her husband and of former Gov. Alfred E. Smith against charges of extravagance, says an Associated Press dispatch to the *Chicago Tribune.*

Speaking of economy in government, Mrs. Roosevelt said:

"It is quite true to say that all governments are extravagant. Neither the Democrats nor the Republicans can quite truthfully say they have been as economical as possible."

"For instance, the Republican legislature last year cut the state budget $21,000,000. Practically all of that came out of the appropriation for the department of public works. Eighty per cent. of the money appropriated to the department of public works goes to pay for labor.

"That $21,000,000 cut meant that thousands of young engineers, draughtsmen and laborers were thrown out of work. The governor, the lieutenant governor and the head of the department all told the legislature that this would happen. But it sounds well to cut $21,000,000 out of the budget, so they did it.

"Later on they were obliged to appropriate for public relief not only what they had cut out of the budget, but more. Now, which would have been better—to pay that money out in salaries for labor on public works, or to pay it in unemployment relief? It wasn't economy at all, you see, because the money had to be spent anyway."

Award Damages in Silicosis Suit

A JUDGMENT of $28,000 in favor of Lasco Graham, 42, of Pacific, Mo., was returned by a jury in Circuit Judge Pearcy's court recently against the Pioneer Silica Products Co. as damages for a disease which Mr. Graham alleged he contracted while employed in mining sand for the company at its Pacific plant. There are 43 similar suits against the company pending.

Testimony was Mr. Graham was suffering from silicosis contracted from powdered sand in the air at the plant. Physicians testified his expectation of life was about ten years because of the disease. Mr. Graham contended the company was negligible in failing to provide respirators and proper safeguards of the health of the employes. The defense of the company was that it was not known the conditions of the plant were harmful.—*St. Louis* (Mo.) *Globe-Democrat.*

Foreman's Safety Conferences

A NEW PUBLICATION, "Foremen's Safety Conferences," has been issued by the Metropolitan Life Insurance Co. It presents one method which is being used rather extensively to develop safety interest among foremen and others in supervisory positions. The report offers suggested programs for a series of seven informal conferences to discuss the several phases of safety work. To provoke general discussion, a series of nine questions is presented for each of the seven conferences, the purpose of each question being explained.

The following subjects are included in the program of conferences: The Reasons for Safety Work; Using Facts to Prevent Accidents; Getting the New Employe Started Right; Helping "the Accident Prone" Employe; Getting the Department Behind the Foreman; The Value of Safeguarding Equipment; The Effect of Good Housekeeping on Safety and Operation.

Buys American Brick Co.

THE Medfield Brick Co., Medfield, Mass., announces it has purchased the property of the American Brick Co. The American Brick Co. has liquidated, paying all creditors in full.

The Medford company has a capital of $40,000. Officers of the company are Fredric S. Snyder, president; Fredrick A. Hartshorn, treasurer, and George D. Dutton, Phillip R. Allen and Parker E. Monroe, directors. C. H. Carmichael is general manager.

The company will specialize in the manufacture of sand-lime brick and in asphalt fillers. It is also interested in new products and will consider cooperative development of such products, Mr. Carmichael announces.

Indiana Road School

THE PROCEEDINGS of the 18th annual road school held at Purdue University early in 1932 have been published as Extension Series No. 28.

A paper of special interest to rock products producers read at the meeting, and which is given in the proceedings, was "Use of Sandstone in Highway Base Course" by B. F. English.

Regarding the use of sandstone in highway base course, Mr. English said, ". . . from experience as well as deduction I will say that when sandstone is cheaper than other materials, by reason of location, it is economy to use it."

A. A. Sutherland

AUGUSTUS A. SUTHERLAND, 67, co-founder, with his brother, Fred W. Sutherland, of the Superior Portland Cement Co. of Seattle, Wash., died at his home October 19. He retired as treasurer of that company in 1925. Mr. Sutherland had been ill for the past two years.

Many Accidents in Rock Products Industry Again Reported

AS WAS NOTED in the August 27 issue of ROCK PRODUCTS, there has been an unusually large number of accidents reported in the industry in recent weeks. The rate seems to have become even greater since then. Accidents have occurred which are not reported. Those which are reported demonstrate the fact that many of these accidents could be prevented by greater care. With indications that operations will extend well into the fall and winter, when hazards tend to increase, every member of the industry should be alert to the importance of safety first measures. The following are among those accidents recently reported:

At Allison, Ia., Lloyd Marker, driving a gravel truck, started across a railroad track in front of a slow-moving freight. The truck was hit and Mr. Marker later died of injuries received in the accident.

Harlin Ahlefeld, Bucyrus, Ohio, a crane operator, was operating the clutch of his crane when his foot slipped and he fell into the engine of his machine. He suffered numerous bruises, burns and lacerations and lost several days work.

James and William Hunt, negroes, were seriously injured while working at a rock quarry near Independence, Mo. A rock slide caught and buried them. They were extricated by fellow workers. The extent of their injuries has not been determined.

August Begemaun, Hartsburg, Mo., was injured recently in a premature explosion of dynamite which blew particles of rock into his face and chest. His father had been injured in a similar accident some months before.

At Chicago, Ill., Harry Evans, engineer on a sandsucker, was fatally injured when he was lowering the anchor by means of a hand winch. The handle spun around and struck him in the head.

J. Clayton Brubaker, Lancaster, Penn., was fatally injured in the crusher building of a quarry near there in August. He was found with his skull fractured and it is believed that he had been hit by a chain attached to a revolving wheel.

At Yakima, Wash., Albert Mack and James H. Drummond were seriously injured by collapse of a bunker at the plant of the Commercial Sand and Gravel Co. This was the first casualty of the year at the plant.

John Kelner, an employe of the Ohio state highway department, was killed at a rock quarry near Celina on August 29. He was standing by the side of his truck when the shovel, which was loading his truck, discharged its load on him. He was completely buried and it was thought he was killed instantly.

At a quarry near Lima, Ohio, Harold Ashby was struck by the bar of an air drill, fracturing two ribs.

William Lindley, Union City, Ohio, while working in a gravel pit was caught in a slide after igniting a charge of dynamite. He was unable to escape and was caught in the explosion. He will lose considerable time, it is reported, beside suffering from shock and injuries.

While riding in a truck of a producer near Pittsburgh, Penn., recently four men were killed and a number injured when the truck slipped down an embankment and overturned.

Cement Plant Completes Six Years Without Accident

THE IOLA, Kan., plant of the Lehigh Portland Cement Co. has just completed a six year no-accident record, in which no employe has sustained a fatal, partial disability or even a lost-time injury, the National Safety Council has announced.

C. A. Swiggett

No cement plant on the American continent has previously succeeded in reaching this record. It covers operations at the limestone quarry as well as in the mill.

"The manufacture of cement has always had its share of hazards," said W. H. Cameron, managing director of the Council, "yet for more than four years the cement industry as a whole has led all others reporting to the Council in low accident frequency. The six year record at Iola offers a new safety mark at which American industry can shoot and proves once again that industrial accidents can be controlled when men make up their minds to do the job."

C. A. Swiggett, superintendent of the plant and chairman of the safety committee, has been swamped with congratulatory telegrams and messages from leaders of the cement industry throughout the country. The record, which was established September 9, is still continuing and strengthens the prestige of the cement business as "America's Safest Industry."

Orders Restrictive Leases and Agreements Cancelled

A CONSENT DECREE has been entered in the Nebraska State Supreme Court sustaining the claim of the state's attorney general that the Lyman-Richey Sand and Gravel Co. of Omaha, which has been in control of 90% of the sand and gravel business in the state, is a monopoly. The court has ordered that it terminate all leases and agreements that have clauses which are restrictive in character and intended to limit or suppress competition and to divest itself within six months of interests in competing companies.—*Wall Street Journal* (New York).

Martinsburg Quarry Wins Crushed Stone Safety Contest

AMID STRONG COMPETITION from other members of the National Crushed Stone Association, the Martinsburg, W. Va., Quarry 5 and 6 of the North American Cement Corp. won the *Explosives Engineer* award for its 1931 safety record, it is announced by J. R. Boyd, secretary of the association.

Sixteen of the many member quarries taking part in the contest worked the entire year without a lost-time accident. The Martinsburg quarry wins the bronze plaque by operating 115,403 man-hours without a lost-time accident.

The other 15 quarries, all of which received honorable mention, worked fewer man-hours. All companies receiving honorable mention are awarded parchment reproductions of the plaque by the *Explosives Engineer* and the association officers.

The results of the annual contest are determined by U. S. Bureau of Mines, in that all members of this safety movement must be enrolled in the National Safety Competition, which is conducted by the Bureau of Mines for the famous "Sentinels of Safety" trophies. Those quarries winning honorable mention in the 1931 contest were as follows:

Rock Hill traprock quarry, Quakertown, Penn., operated by the General Crushed Stone Co. Quarry worked 112,819 man-hours.

Hillsville crushed limestone quarry, Hillsville, Penn., operated by the Union Limestone Co. Quarry worked 99,622 man-hours.

Columbia No. 3 limestone mine, Valmeyer, Ill., operated by the Columbia Quarry Co. Worked 97,788 man-hours.

Birdsboro crushed-stone quarry, Birdsboro, Penn., operated by the John T. Dyer Quarry Co. Worked 91,209 man-hours.

Akron limestone quarry, Akron, N. Y., operated by the General Crushed Stone Co. Worked 89,764 man-hours.

Rock-Cut limestone quarry, Syracuse, N. Y., operated by the General Crushed Stone Co. Quarry worked 84,004 man-hours.

Security limestone quarry, Security, Md., operated by the North American Cement Corp. Quarry worked 80,011 man-hours.

Middlefield traprock quarry, Wallingford, Conn., operated by the Connecticut Quarries Co., Inc. Quarry worked 78,123 man-hours.

Knippa No. 4 traprock quarry, Knippa, Texas, operated by the Southwest Stone Co. Quarry worked 67,816 man-hours.

Gasport dolomite quarry, Gasport, N. Y., operated by the Wickwire Spencer Steel Co. Quarry worked 63,340 man-hours.

Speed Mill cement quarry, Speed, Ind., operated by the Louisville Cement Corp. Quarry worked 57,366 man-hours.

Hendlers quartzite quarry, Wilkes-Barre, Penn., operated by the General Crushed Stone Co. Quarry worked 45,045 man-hours.

Duluth traprock quarry, Duluth, Minn., operated by the Duluth Crushed Stone Co. Quarry worked 42,078 man-hours.

Rocky Hill traprock quarry, Rocky Hill, Conn., operated by the Connecticut Quarries Co., Inc. Quarry worked 33,521 man-hours.

Mt. Carmel traprock quarry, Mt. Carmel, Conn., operated by the Connecticut Quarries Co., Inc. Quarry worked 17,224 man-hours.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

A Successful New Concrete Product—"Madestone"

By Miles N. Clair

Vice-President, The Thompson and Lichtner Co., Inc., Boston, Mass.

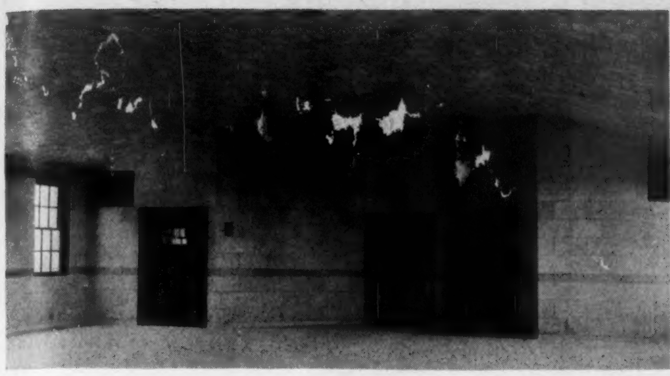
SEVERAL YEARS AGO an organization, composed of men with years of experience in the manufacture of cast stone, was formed in Boston, Mass., to make a superior concrete building unit, and the result is today the ""Madestone" products. "Madestone" products include solid and hollow units for exterior and interior facing and partitions made with light weight aggregate or combinations of aggregates if necessary for architectural treatment.

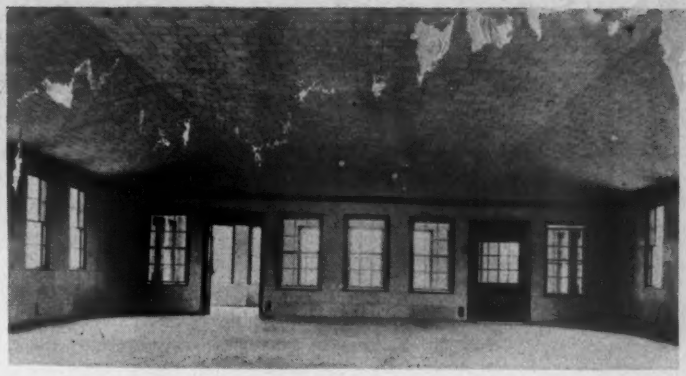
Structure faced with "Madestone" on interior

"Madestone" is manufactured under unusually carefully controlled conditions so as to insure uniformity of product and low costs. The quantities of cement, aggregates, color and water are measured under the direct supervision of a foreman. The mortar is mixed a definite period and discharged into buggies for distribution to the molds. Both wooden and steel molds are used and the mortar is compacted by special vibration methods developed after many months of study and experimentation. The usual methods of placing and compacting mortar for cast units result in considerable porosity and surface voids. Such porosity is particularly objectionable where units with finished faces are required. The methods developed for placing the mortar practically eliminated this trouble.

After the units have been made the forms are covered with Sisalkraft paper and kept at a temperature not less than 70 deg. F. for 20 hours and then the forms removed. The units are placed on hand-lift trucks and moved to the storage section, where they are kept moist and at 70 deg. F. for seven days. The faces of the "Madestone" units are then ground to remove the thin surface film of cement and to correct any lack of trueness of dimensions. If any voids show up, the stones are moved to the filling department. When the surface voids have been filled the surfaces to be finished are treated on either a rubbing bed, under a carborundum wheel, by hand-honing, or by other methods similar to those used for finishing natural stone according to the finish desired. As much of the product is laid with ⅛-in. joints, only a few hundredths of an inch tolerance in

"Madestone" in plant yard ready for shipment and protected by paper





Views showing use of "Madestone" for interior facing and partitions

dimensions is allowed. It is possible to meet such requirements economically by the use of very accurately made steel forms and careful finishing work.

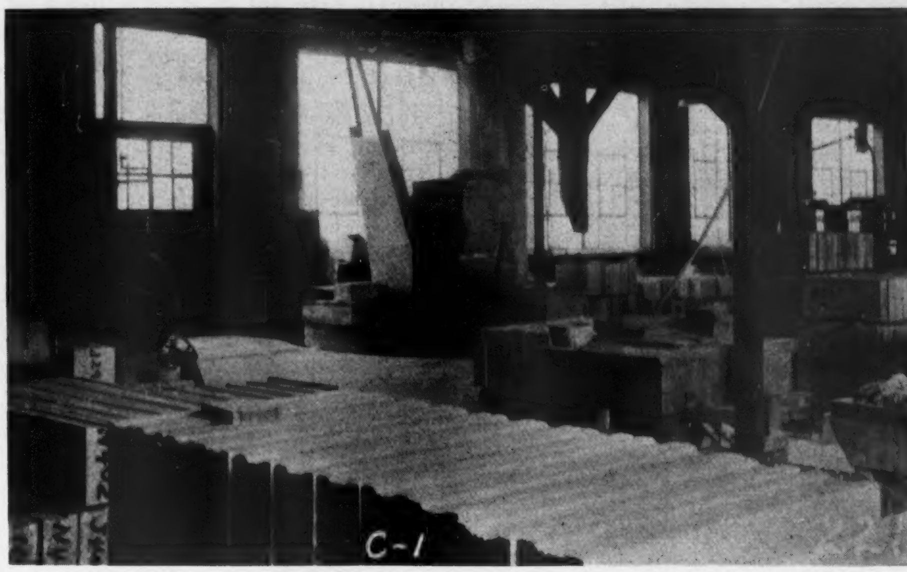
Time Studies for Cost Economies

The operations in the manufacture of "Madestone" units have been subjected to very careful time studies in order to arrive at the lowest possible costs. Quality at the same time is maintained not only by careful company inspection, but also by certification by an outside organization which inspects and makes tests of all shipments before they are released.

The trade employed to set the "Madestone" units depends on the type of unit. Marble setters have been utilized for setting 1-in. thick "Madestone" furring and stone masons and bricklayers for 4-in. "Madestone" partition units.

"Madestone" partition and wall furring units have recently been used in three new structures for the Department of Mental Diseases of the State of Massachusetts, located respectively at Waverly, Monson and Wrentham. The architect for these structures is Clarence P. Hoyt, 6 Park street, Boston, Mass.

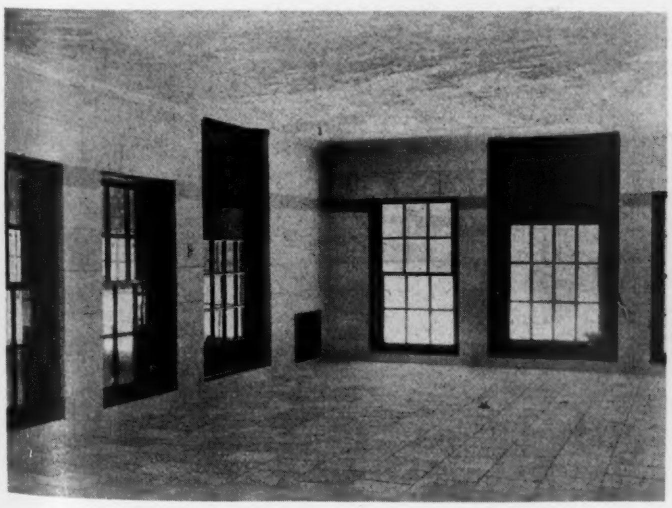
There were 66,000 sq. ft. of wall surface of "Madestone," honed finish, furnished for the above jobs, of which 25% was 1-in. thick for the inside facing of the load-bearing exterior walls, 25% was 4-in. thick with one finished face to be used in partitions where heat and vent ducts were required and 50% 4-in. thick with two finished faces for other partitions.



Mixing section of Allston plant of Madestone Products Association

The 1-in. material was applied directly to the masonry walls with $\frac{3}{8}$-in. cement-lime mortar between the back of the "Madestone" and the masonry wall. The specifications called for $\frac{1}{8}$-in. beds and joints, and because of this a mortar groove was cast in the 4-in. "Madestone" for a proper bond.

The course heights were 11 in. and the average lengths were 1 ft. 10 in., thus allowing the architect to express his best thought in regard to the interior finish. Shop drawings were made by the Madestone Associates and were approved by the



Additional views of interior facing and partitions of "Madestone"

"Madestone" compared with ordinary concrete block

architect before the manufacturing of "Madestone" was started. This gave the architect full control of the appearance of the finished walls. All lintels, whether 1 in. or 4 in. thick, were made in one piece, properly reinforced, and all other specials, such as miter corners, were given a 4-in. return. The result is a very pleasing interior finish of stone-like appearance of a warm golden buff color of various shades that blend into one and another.

The advantages of the use of the "Madestone" unit, which include adaptability to architectural treatment, light weight, low cost of erection, high fire resistance, good acoustical properties and low maintenance cost, have given it such favor locally that consideration is being given to financing for the erection of a new plant laid out for the most efficient manufacture of this product.

C. G. Sherman is manager of the Madestone Products Associates and the engineering division of The Thompson and Lichtner Co., Inc., of Boston, acts as consulting and certifying engineers.

A. C. I. Nominating Committee Reports

THE NOMINATING COMMITTEE of the American Concrete Institute reports the following unanimous nominations for offices to become vacant at the convention to be held in Chicago, February 21-24: President, S. G. Hollister, term 1 year; vice-president, P. H. Bates, term 2 years; treasurer, Harvey Whipple, term 1 year; director, 3rd district, J. C. Pearson, term 2 years; director, 4th district, John J. Earley, term 2 years; and director, 5th district, F. R. McMillan, term 2 years.

To Feature Electricity in Industry

A SECTION of the General Electric Research laboratory in Schenectady, N. Y., the "House of Magic," will be one of the features of the company's exhibit at the Century of Progress to be held in Chicago in 1933. The application of electricity to industrial uses and transportation will also be featured. It is expected the company will occupy the largest space of any exhibitor.

A New Industry—Manufacture of Sound-Absorbing Materials

IN the U. S. Bureau of Standards files there is to be found the record of the development of a new industry. This of itself is noteworthy, but additional interest attaches to this case from the fact that fully three-quarters of this development has occurred during the business depression of the last three years. This is the manufacture of sound-absorbing materials for use in correcting the acoustic quality of auditoriums.

Though the underlying principles of architectural acoustics have been known for nearly 40 years, the subject attracted but little attention from those who should have been interested until the introduction of talking pictures. It was then found that many theaters which had been built for silent pictures were acoustically almost useless. This discovery stimulated the study of means for correcting the difficulty and directed attention to such sound-absorbing materials as were then available.

These materials were limited in number, and some of them were serious fire risks. Development of new materials to meet the demand brought requests for service in the measurement of their sound absorption.

In 1928 the facilities for this work were limited to two laboratories, both in the state of Illinois. In the fall of 1928 the Bureau of Standards completed a reverberation room for making such tests and placed it in service. During the remainder of that year its facilities were used by two manufacturers.

In 1929 seven different firms sent material for measurement, and this number was increased to 18 in 1930 and 23 in 1931, in which year the total number of samples measured was 97. For the first half of 1932 the demand for service of this character has been considerably in excess of the 1931 rate.

Another measure of the extent to which the bureau has been connected with this new manufacturing development is found in the increasing correspondence on the subject. So frequent became letters of inquiry regarding acoustic materials that early in 1930 it became necessary to issue a "letter circular" on the subject. The first edition of this circular in March, 1930, listed 11 materials which the bureau had measured up to that time. Seven editions of this "letter circular" have been called for, each edition listing an increasing number of materials. The latest edition, of April, 1932, lists 37 different materials, with varieties of each, totaling 87.

In addition to furnishing this service, the bureau has been called upon by architects for advice regarding the preliminary calculation of the acoustic quality of a proposed auditorium. It has become an established rule of the government architects to submit to the bureau all plans for new federal court rooms throughout the country for suggestion and criticism in this respect.—*Technical News Bulletin*, U. S. Bureau of Standards.

Protection Asked Against Dumping of Cement

UNDERSELLING by British cement interests "has taken away every dealer that we had in greater Newark, which was our important market," John H. Ackerman of the Lawrence Portland Cement Co. testified at a hearing October 21 before the United States Commissioner of Customs on a charge that British producers are dumping their product on the American market. Of more than 30 representatives of American cement manufacturers present at the hearing, nine others said they had experienced the same loss. Today there are only two dealers in Newark who handle American-made cement, and these are under contract. Price differential was given as the cause of this condition. Now the New York market is threatened by this same competition. Such was the evidence presented in support of the plea that the Treasury Department issue an order of suspected dumping at once and to delay an order of dumping "only so long as it takes to make the required investigation at high speed."

Much of this dumping has resulted since the gold standard was abandoned by England. Sales are being made on a basis that nets English mills 40c. per bbl. at their plants, while these same plants are offering their cement at $1.16 per bbl. in and around London, Albert Barnes, attorney for the American interests, asserted as evidence for his claim that this practice was "pure, unadulterated dumping."

Cost of production of American cement was presented, the cost per barrel of labor alone being shown as 37c. If American plants are to reopen and reemploy necessary labor for production, some action by the government is necessary to correct these conditions, and immediate steps to provide this protection was urged.

To Meet in Chicago

THE 29th annual convention of the American Concrete Institute is to be held in Chicago, Ill., February 21-24. The program provides one morning and one afternoon during which those in attendance may visit points of interest.

The program has not been completed as yet. More than 40 program items are on the program schedule, with vibrated concrete being scheduled for special consideration.

Erratum

IN an article on page 40 of the August 27 issue of ROCK PRODUCTS, describing the batching plant of the Steckel Sand Co., Easton, Penn., the aggregate storage bin was stated to be a 3-compartment 150-ton Blaw-Knox bin.

We are informed that this was in error in that this is a Beaumont bin.

Medusa Introduces New Type of Cement for Macadam Binder

THE MEDUSA PORTLAND CEMENT CO., Cleveland, Ohio, is going to make a bid with a new product for the market in so-called secondary road construction, as well as resurfacing jobs, now constituting a large part of the asphalt and tar products highway markets. The new product is a combination of bituminous substances and portland cement. It is used as a binder in macadam type roads.

Dr. Albert Sommer, formerly a research chemist for the Texas Co., some years ago introduced a surfacing for worn macadam pavements in Germany and applied this surfacing to many miles of roads. While engaged in this work he recognized the need of a hard-wearing surface that could be constructed economically and which would require a minimum of maintenance.

New type road constructed at Toledo, Ohio, plant of Medusa Portland Cement Co.

This resulted in the development of a binder combination of bituminous substances and cement. Dr. Sommer then secured a number of cement companies to produce the material on the continent, and approximately 200 miles of roads have been treated in this manner in the past two years. Most of this mileage has been in short stretches of one to two miles, and a wide variety of conditions are included in these installations. It is reported that in the two years of service these roads have uniformly given splendid results. This surface is laid without expansion joints and it is said that no cracks have developed when placed as recommended.

Dr. Sommer came to the United States in October, 1931, and discussed his development with the Medusa Portland Cement Co. As a result the company produced some of the material in November and laid a half mile stretch in the yard of its plant at York, Penn.

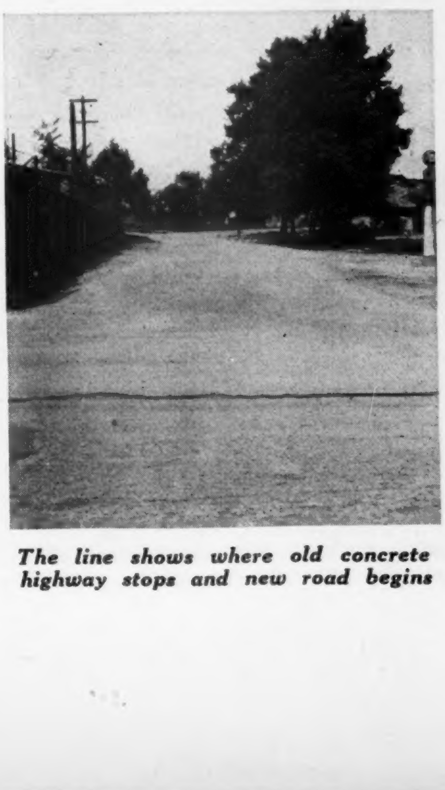
Immediately after the roller was off the road, traffic was put on, to the extent of 3- and 5-ton trucks which were hauling cement from the plant. This road went through the winter 1931-1932 with no indications of cracks or any deterioration or ravelling of any kind. The section of the road that was put over the railroad cross-over has been subjected to vibration caused by locomotives and freight cars that daily pass over this, yet the road is said to be as good as the day it was put in.

In the spring of 1932, in order to further carry on investigations, the Medusa Portland Cement Co. sent a representative to Germany to look over the roads that had been constructed in that country. His report states that everything claimed for these roads was true.

Shortly after his trip the Medusa company constructed a road at its plant at Toledo, Ohio, about a half mile in length. This road took traffic immediately after the rolling was finished and is said to be holding up perfectly.

As a result of its investigations the Medusa Portland Cement Co. has taken over the rights to manufacture the material in this country and has organized for that purpose a subsidiary company, known as the T. R. C. Corp. (Temperature Resisting Cement Corp.). This subsidiary company has licensed the Medusa company to make this product and is ready to license other manufacturers.

Necessary equipment to produce the material has been installed at a number of the Medusa plants and experimental sections of the surfacing are now being placed. At Great Barrington, Mass., a stretch of 1000 ft. has been put down as a 2½-in. covering over some old concrete. There is now being constructed at Chicopee, Mass., 2000 ft. of 20-ft. road covering an old gravel road. A stretch of 150 to 200 ft. will soon be finished on a 40-ft. section of concrete west of Providence, R. I., on the Boston Post road. About 1⅓ mi. will be constructed near Cedarburg, Wis.



The line shows where old concrete highway stops and new road begins

The half dollar shows the size of the stones

Both street and highway officials have shown considerable interest in this new development when it has been described to them. With the properties claimed for it the material may prove of value to the cement industry in winning an increased portion of the road building dollar, both for resurfacing of concrete and for other types of roads.

Finds Many Possibilities for Glass of Slag

ALREADY SUCCESSFUL in making glass from blast furnace slag, Dr. C. A. Basore, professor of chemistry at Alabama Polytechnic Institute, is conducting further experiments. Dr. Basore's present endeavors are directed toward perfection of the results already obtained.

From the slag of the Birmingham steel industry Mr. Basore has made a transparent aluminum glass, a black opaque glass, and a type of glass which without additional treatment naturally obstructs the vision.

Each type is of high quality and may be produced much cheaper than glass now on the market, Dr. Basore says.

The appearance of the black opaque glass made from slag suggests use for tiles, floors, plasters and various decorative purposes.

Since the manganese dioxide is required to give the black color, as is now required in ordinary glass, Dr. Basore believes the slag glass could be manufactured at considerably less than present costs.

The transparent aluminum glass made from slag has a tensile strength far above that of ordinary glass, and it has shown a high resistance to corrosion.

Dr. Basore has also succeeded in making a glass from slag which greatly diffuses light.—*New York* (N.Y.) *World-Telegram.*

A New Cement Kiln Refractory*

By C. H. Sonntag

Plant Manager, Lawrence Portland Cement Co., Thomaston, Me.

THE SELECTION of a satisfactory lining for the hot zone of rotary cement kilns is a matter that is becoming of increasing importance. Our ideas of what makes a suitable kiln refractory are a heritage of the past 35 years of rotary kiln practice. When this type of kiln was first taken up the thought that was apparently uppermost as to its lining seems to have been that it should resist the temperatures involved and protect the steel shell, but the conditions under which it should do this were not considered to be essentially different from those obtaining in any other high-temperature furnace.

To a certain extent this position was justified. Specifications for cement, and process requirements for making that kind of cement, were more liberal than they are now. Many of the raw materials used in the early days of rotary kiln practice were more easily clinkered than those of today. There was not the constant urge to keep the lime as high as possible consistent with soundness, and consequently its percentage was relatively low in many older cements. High strength, and especially high early strength, was not called for. Many operators believed in the "long, lazy flame." It followed that burning temperatures were lower, and the hot zone refractories benefited thereby.

Now all these conditions are changing, and will probably continue to change for some time to come. High early strength, with its concomitants, high lime content and thorough burning, is in demand. It is inevitable that hot zone refractories should give shorter life under this more severe punishment, and the search for better lining material, once more or less academic, has become very active by both cement and refractory makers.

Special Conditions in Cement Kilns

A rotary cement kiln lined with ordinary fire-brick differs from most other industrial furnaces. In the latter the slag, if formed at all, is usually of an acidic or siliceous nature. (The manufacture of steel by the basic process is one of the exceptions to this.) While there is a certain amount of fluxing away of the lining, there is no very great tendency for chemical action between slag and brick, because they are more or less of the same nature, since high-grade fire-brick, even when approaching kaolin in analysis, may be considered to be chemically acid at a sufficiently high temperature.

In direct contrast to this, in the cement kiln we have been heating cement clinker, a highly basic substance, in contact with an acid refractory. The temperature in a kiln is not high enough to melt either the clinker or the brick if taken alone, but when they are in contact at this temperature a new condition is brought about in which the fusibility of the separate substances is not the most important circumstance to be considered. Although neither brick nor clinker is actually melted, the temperature is high enough to permit chemical combination of the silica and alumina, acting as acids, and the lime acting as a base, through the surfaces in contact. The result is the formation of silicates and aluminates of more or less indefinite and unknown composition which have much lower fusing points than either the clinker or brick. This layer of low melting point forms on the inner surface of the brick when the first raw material or clinker touches it after the kiln has reached its working temperature. This layer, formed by true chemical action, might, under conditions to be explained presently, be able to hold a protective coating, but another phenomenon, more physical than chemical in its nature, is of equal or greater importance in the formation of a coating.

Eutectic Formation

It is a well-established fact that when two substances are heated together until melting begins, a mixture is formed that in most cases has a lower fusing point than either constituent when heated alone. This new substance of low melting point is called a eutectic. It is not necessarily a true chemical compound, and when formed by heating several substances together its nature might be rather hard to define, but its formation plays a very important part in the behavior of refractories when in contact with slags at high temperatures. Cement clinker may be considered to be a very basic slag.

Obviously in the operation of a cement kiln we are creating an almost ideal condition for the formation of a eutectic. Good fire-brick consists essentially of silica and alumina, both chemically acid at high temperatures. Clinker contains over 60% of lime, which is a powerful base at any temperature and is even more so when white hot. It is inevitable that a layer of relatively easily fusible eutectic should form between the brick and clinker, and it actually does form, as may easily be seen by inspection of the hot zone of a kiln that has been shut down with the coating in place. This eutectic acts much like glue in holding a layer of clinker on the brick so that direct scouring action is prevented.

Effect of Radiation

It is in order to ask why, if this easily fusible layer is present, the clinker that sticks to it does not fall off or "slip" and leave the brick exposed. The answer is found in the conduction of heat outward to the kiln shell and radiation from its surface.

Most mixtures containing silica have no sharp melting point, but pass through a syrupy or pasty stage between solid and liquid. When a new lining is brought to clinkering temperature, conduction of heat through the lining and shell begins, and the temperature of the inner surface of the lining is the resultant of the heat received by it from the flame and the heat passed out by conduction through the brick and shell and radiated into the air.

Formation of Coating

When the first calcined raw material comes down on to the white-hot surface of the brick the eutectic just spoken of is formed, and for a while is in a pasty condition. The operator so regulates the temperature that the eutectic shall not become too fluid, and more calcined raw material or clinker adheres to it. Now just as soon as a layer or coating of clinker is formed the eutectic is protected from the direct action of the flame, and so does not receive so much heat. But outward conduction and radiation continue, so that the eutectic cools down somewhat and becomes solid. It will remain so and hold its coating unless the temperature of the kiln is raised to such a point that it again becomes more or less soft and pasty, when the coating will fall off or "slip," and the process of building it up must be gone through again. If a new coating is not promptly formed the brick will be rapidly worn away by abrasion and scour.

This is briefly the mechanism of the formation of the protective coating in the clinkering zone of a cement kiln, and it is plain that the outward flow of heat through the brick and shell play an important part in the preservation of the brick. This has also been proved in other ways.

(a) In recent years many kilns, and especially the larger ones, have been fitted with linings 9-in. thick. It has been a frequent experience that a permanent coating could not be built up on such a lining until 3 or 4 in. of the brick had been worn away, and this usually happens within a few days after starting up on a new lining. It is apparent that conduction of heat through the thick brick is not rapid enough to cool down the layer of eutectic so that it can hold a coating.

(b) It has been proposed to conserve

heat in the kiln by putting a heat-insulating layer between the brick and the shell, with the idea of cutting down the loss by radiation. Theoretically the greatest saving could be made by insulating the clinkering zone, for here the temperature is highest and radiation greatest. Most of these installations have given trouble through their very effectiveness, for radiation was cut down to such an extent that the eutectic became so hot and fluid that it could not hold a protective coating, and the bare brick were rapidly worn away by the fluxing and abrasive action of the clinker.

(c) Years ago in the days of small kilns it was felt by some that there should be a 3-in. layer of inferior brick next to the shell,

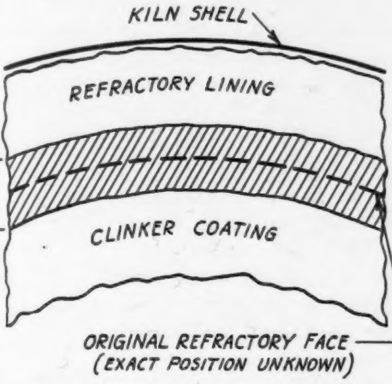


Fig. 1. Eutectic shown by section A B

this layer being in turn lined with 6-in. of high-grade brick on which the burning was supposed to be done. Very frequently the 6-in. brick would burn out in a week or two, and operation would continue for a long time on the 3-in. layer. Here conduction through the thin lining was effective enough to permit a coating to build up on brick that were not supposed to be good enough for the purpose.

A cross-section of a properly coated kiln lining is shown in Fig. 1, in which the area *AB* includes the eutectic that has been spoken of. Its distance from the steel shell and the depth of the area *AB* depends on how much of the orignal thickness of the brick is left and on the kind of brick of which the lining is made. Fig. 2 is an attempt to show the temperature gradient between the inner surface of the coating and the atmosphere surrounding the shell. The temperatures shown are approximate only, since they are affected by the thickness of the coating and lining and the nature of the exposure of the outside of the shell. The kiln may be in a tight building in which the air temperature may become relatively high, or it may have no covering at all, and be subject to rain and wind, both of which are quite effective as cooling agents.

Under the older kiln practice it was common to blow coal dust into the kiln with just enough air to act as a conveyor, and only around 20% of the air needed for combustion was introduced in this way. The rest was drawn in around the hood and up through the clinker chute by the draft of the kiln. The resulting flame was long and not very hot in any one place, and in consequence long service could be had from the hot zone lining.

With the demand for more thorough vitrification this state of affairs is changing. In many modern mills 40 to 50% of the required air is blown in with the coal, and the size of the injection pipes is so chosen that combustion is rapid and complete, and the temperature is highest within a few feet of the discharge end of the kiln. As a result in some plants even the highest types of fire-clay brick have been practically ruled out of the picture because of their short life, and runs of not over two months are not uncommon in some mills with refractories costing over twice as much.

Theoretical Linings

From a theoretical standpoint the lining of the hot zone of a cement kiln should be basic instead of acid, for there would be little or no tendency toward chemical action between clinker and brick, and the eutectic, if formed, should have a higher melting point.

If other considerations could be cast aside the lining should of course be made of clinker, since it would be of the same composition as the material passing through the kiln, and so there would be no chemical action between them. Quite a number of years ago liner blocks were made by a few cement companies from a mixture of clinker and cement, and for a time they were said to give good service, but their use has decreased as time has passed, so that it may be safely said that they did not in the long run give a good account of themselves.

Since a lining made of clinker is not practical, the next logical choice would be one made of lime, as it is not too greatly different in composition from the clinker that would be heated in contact with it. It seems to be unfortunately true, however, that no means is known whereby lime can be made into a stable brick, and the same thing can be said of its near relative dolomite, though the latter is used as a rammed lining in certain types of metallurgical furnaces.

Alumina is another substance that theoretically, at least, holds out hope of making a better kiln lining than fire-clay. Chemically it may be either acid or basic, according to circumstances. In the presence of silica in large quantities it acts as a base, and becomes a constituent of a few simple silicates and many complex ones that involve other elements. In the presence of much lime it behaves as an acid, forming aluminates. Alumina as a kiln refractory is usually marketed in the form of bricks containing about 70% of the pure compound. These bricks or blocks are in use by many cement mills today because their longer life as compared to first quality fire-clay brick justifies their higher cost.

Still another material that has for a long time been considered in this connection is magnesia. Unlike lime and dolomite, it can be made into blocks that will not disintegrate in storage. It is a powerful base, and so will not react with the lime in the clinker. In fact, its basicity raised the question as to whether it could be made to take and retain a coating, and this was not settled until recently.

Very little published matter on the use of magnesia lining in cement kilns has come to the writer's attention. It is barely mentioned by Eckel and by Meade in their books on the manufacture of cement. Neither speaks of it as holding out any promise of successful use. It is a matter of more or less common gossip among cement men that four or five attempts to use magnesia lining have been made in the past, and each has resulted in failure brought about by disintegration of the brick.

Commercial Considerations

Any hot zone lining that is to receive serious consideration must be commercially available in sufficient quantity at a price that

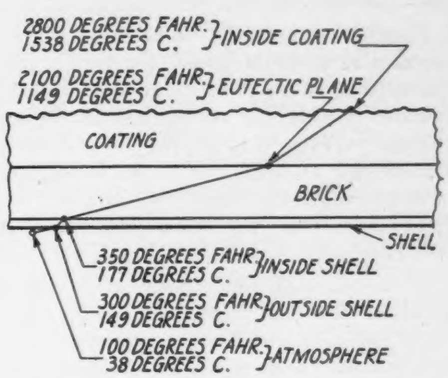


Fig. 2. Heat gradient from inside of coating to outside of shell

warrants its use when all the factors involved in its application are taken into account. In view of what will be said later, it appears that there are now three refractories that are to be thought of when lining a cement kiln: fire-clay brick, high alumina brick and magnesia brick. Choice depends on conditions of operation, meaning by this whether clinkering is at a very high or more moderate temperature, and whether the flame is short and intense or longer and milder. Selection of a higher grade and more expensive lining should be on the basis of the life that has been obtained from a cheaper one, and when a cheap lining has been lasting but a short time the use of a more expensive one should be given detailed study. It will probably turn out that the over-all cost of making clinker will be lowered in spite of the higher first cost of the better brick.

How a Coating Is Retained

The difference in service given by different refractories depends, in the writer's opinion, on their ability to pick up and maintain a protective coating, and this in turn depends

on the nature and fusing point of the eutectic formed between the brick and clinker, and on the ability of the brick to conduct heat to the exterior of the kiln.

Hansen[1] has made a study of the action of magnesia in certain high-temperature melts. His tests, however, were limited to compositions near to that of portland cement containing 5% of magnesia. He has shown that in a mixture of this composition liquid will begin to form at 1300 deg. C. (2372 deg. F.), and this confirms the general knowledge in the industry that the presence of a small amount of magnesia promotes clinkering.

The conditions at the interface between clinker or coating and magnesia brick are altogether different than in the interior of a mass of magnesian clinker. A small amount of liquid will probably form at 1300 deg. C. (2372 deg. F.), as in Hansen's work, but it will be in the presence of a very large excess of magnesia which will not enter into chemical combination,[2] and will act like a blotting paper or sponge to absorb the liquid and prevent its acting as a plane of weakness between the brick and coating.

One other fact helps to maintain a good coating on magnesia brick. Assuming a constant flame temperature and a definite thickness of coating, the temperature at the interface between coating and brick depends on the rate at which heat is conducted outward through the brick. The higher this rate is, the lower will be the temperature at the interface.

Now the heat conductivity of magnesia brick is considerably more than that of ordinary fire-brick and high-alumina brick. It follows that with a magnesia lining, heat reaching the interface through the coating will be more rapidly transmitted to the kiln shell, and consequently the temperature of the interface will be lower than it would have been under similar conditions with other refractories.

No actual measurements of interface temperatures have been made to prove the foregoing, but the soundness of the reasoning is confirmed by the fact, demonstrated in the trial herein described, that magnesia brick do take and hold a coating better than the other types of lining that have been used in this mill.

It is of course easy to theorize about these things, but the real value of a theory depends on its confirmation in practice. Since magnesia appears on theoretical grounds to be a desirable material from which to make a hot zone lining, the next logical step would be to try it out in a commercial kiln under actual every-day working conditions.

As has already been mentioned, there is practically no information in print on magnesia linings, and the general impression seems to have been that magnesia is inherently unsuitable for this purpose. In spite of this, when an opportunity to try magnesia brick made by a new process was offered it seemed best to set all doubts at rest by making the experiment of which the details follow, and the executives of this company felt that a worth-while contribution to our knowledge of cement technology would be made, no matter which way the test turned out. The trial was made in one of the two kilns of this mill.

These kilns are 11 ft. in diameter and 200 ft. long with a slope of ⅜-in. per foot, have

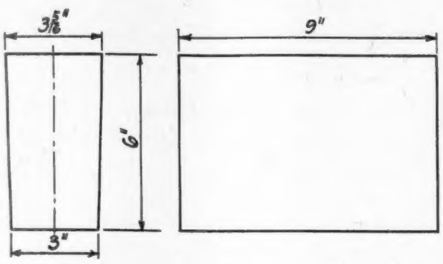


Fig. 3. Detail of brick which is laid parallel to axis of kiln

four tires, and are driven at speeds varying from 90 to 180 sec. per rev. by slip-ring motors. The drive is positive through gears only. The kilns are alike in every way except as to linings.

The raw material is a mixture of high- and low-limed stone. A small amount of sand is added to the mix before grinding to raise the ratio of silica to alumina. Occasionally a little clay is used. The plant uses the wet process, making a slurry containing 38% of water. An installation of filters produces a cake carrying 18% of water which forms the kiln feed. Each kiln has its own group of filters. The Ferris wheel feeders that measure out the slurry to the filters are mechanically connected to the kiln drives, and as the filters are not allowed to overflow a definite weight of feed is introduced into the kiln at each revolution. An exceptionally complete blending and correcting system assures feed of uniform composition.

The fuel is powdered coal. It is measured out from the storage bins by one Bailey feeder for each kiln. The discharge from this feeder is into two injectors which carry the coal to the kiln through two 12-in. pipes. In other words, each kiln has two coal pipes. Each injector has its own air gate, and fans, injectors and piping are such that up to 50% of the air needed for combustion may be blown in with the coal. The bifurcated spout from the Bailey feeder to the injectors has a flap valve at the dividing point so that the coal stream may be divided between the injectors in any ratio desired.

Clinker drops from each kiln into a 9 by 90 ft. rotary cooler, and most of the air passing through the cooler is drawn into the kiln by the draft, which is furnished by individual stacks 11 ft. inside diameter and 200 ft. high above the gas entrance. The air drawn from the cooler into the kiln is of course highly preheated.

Prior to this experiment the hot zone linings used were, with one exception, of the so-called high alumina type. This exception was of first quality fire-clay brick. High alumina brick from three manufacturers were used, and no appreciable difference between them as to length of service or otherwise was observable. The magnesia brick discussed in this paper were obtained from one of these firms, so that the comparison is really between two refractories produced by the same manufacturer. Since we were concerned only with the hot zone lining, the brick in the balance of the kiln were not disturbed.

It is generally understood that in previous attempts to use magnesia as a hot zone lining the crude magnesite was calcined to magnesia, ground and mixed with a little clay or other bonding agent, and burned again at a high temperature. The brick used in this trial are understood to have been made from crushed calcined magnesite, which of course is changed by the calcining to magnesia. This is mixed with a small quantity of a bonding agent whose nature

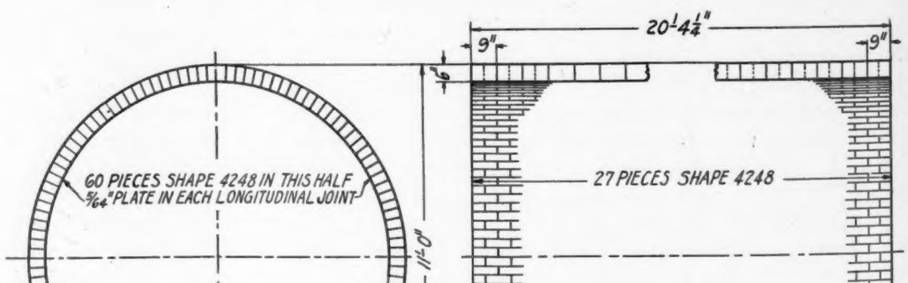


Fig. 4. Detail of magnesia lining as installed

[1]Hansen, W. C. The Influence of Magnesia, Ferric Oxide and Soda upon the Temperature of Liquid Formation in Portland Cement Mixtures. Paper 22, Portland Cement Association Fellowship, Bureau of Standards. Bureau of Standards Jour. of Research, January, 1930.

[2]See footnote on page 64 of reference 1.

has not been disclosed, and filled into molds into which it is compacted by a hydraulic press under a load of 10,000 lb. per sq. in. The brick are ready for use in a day or two, as they are not again calcined.

Design of Magnesia Lining

In American practice, kiln brick usually have the shape of so-called cupola block which have their longest dimension in the direction of the circumference of the kiln. The magnesia brick were, at the suggestion of the maker, designed to resemble what we know as arch brick, and were specially shaped to fit the 11-ft. kiln shell. The details of a brick are shown in Fig. 3, while Fig. 4 shows how the lining was put in. The magnesia lining actually began at a point 9 ft. from the discharge end, and was 15 ft. long. It extended over the section that had heretofore given the most trouble.

The lining is only 6 in. thick, and it was feared that because of the slight taper of the brick there was danger of collapse during the heating-up period, but no trouble of this sort was encountered.

In renewing the nose brick at the discharge ends of our kilns we have for some time been putting a thin sheet of steel in every joint, since we have found that at the temperature that exists at the nose the oxide of iron that forms does not seriously attack the brick, and in swelling tends to hold them in place. We had never tried the use of steel between the bricks in the hot zone, due to the fact that at the high temperature there the iron oxide that forms is decidedly basic, and as the previous lining materials were acid it was felt that the reaction between the two would form a combination of too low melting point to allow the lining to be of maximum effectiveness. But since the magnesia lining is basic, it was thought to be well to find out whether the idea had value with this class of refractory.

Accordingly, half the lining, measured circumferentially, was set with a piece of No. 14 steel (5/64 in. thick) in each longitudinal joint. The other half was placed with nothing in these joints.

To prevent any possibility of the lining "heaving" or buckling due to expansion, pasteboard 0.045 in. thick was put in each transverse joint. As these joints are staggered, a great many small pieces of pasteboard were called for. They were quickly and cheaply cut in a local printing shop. The use of both paper and steel separators was at the suggestion of the refractory manufacturer. The brick were laid dry, no mortar or grout of any kind being used.

The rivets in the kiln shell are not completely countersunk on the inside, but have what are usually called pan heads. It was felt that in justice to the brick they should be laid in good contact with the shell, so that there should be no air space to interfere with the outward conduction of heat. This meant that the brick should have depressions cut in them so that they would bear on the shell rather than on the rivet heads. This looked like a tedious and costly job, but one of our men, A. H. Guptil, suggested a compressed air tool which he had seen used in this way some years ago. The tool is one used by granite workers for lettering and fine carving. These are made in Rockland, about three miles from our mill, and so it was easy to get one for trial. The results were so unexpectedly good that cooperation with the manufacturer resulted in the development of a special tool adapted for use by our brick masons, and we now do all of our brick trimming in this way. Fig. 5 shows Mr. Guptil cutting brick by this means. The tool may be used either for gouging out recesses for rivet heads or for taking off an entire side of a brick, as is usually necessary in fitting keys. There is no comparison between this and the old method of trimming with a brick hammer and the result was a very smooth and well-fitting lining, as shown in Fig. 6.

Magnesia brick have had in the past a rather bad reputation for spalling. With this in mind, it was felt that more than ordinary care should be used in starting this lining to work. It was warmed up slowly by building in the discharge end of the kiln a fire of old timbers, railroad ties and other scrap wood, making this more intense for a period of 18 hours before starting the powdered coal. No spalling whatever took place, and we believe that such extreme care is not necessary.

The greater thermal conductivity of magnesia brick as compared with other refractories has already been mentioned. Because of this it was feared that overheating of the shell might result, especially as the new lining was inside the first tire. When first warmed up, heat did come through the shell much more noticeably than had previously been the case with high-alumina brick, but the temperature never became high enough to cause concern. As soon as the coating formed the shell cooled down, and except at the end of the life of the brick the shell was

Fig. 5. View taken during installation of 6-in. lining of magnesia brick. Note use of compressed air tool for trimming the brick

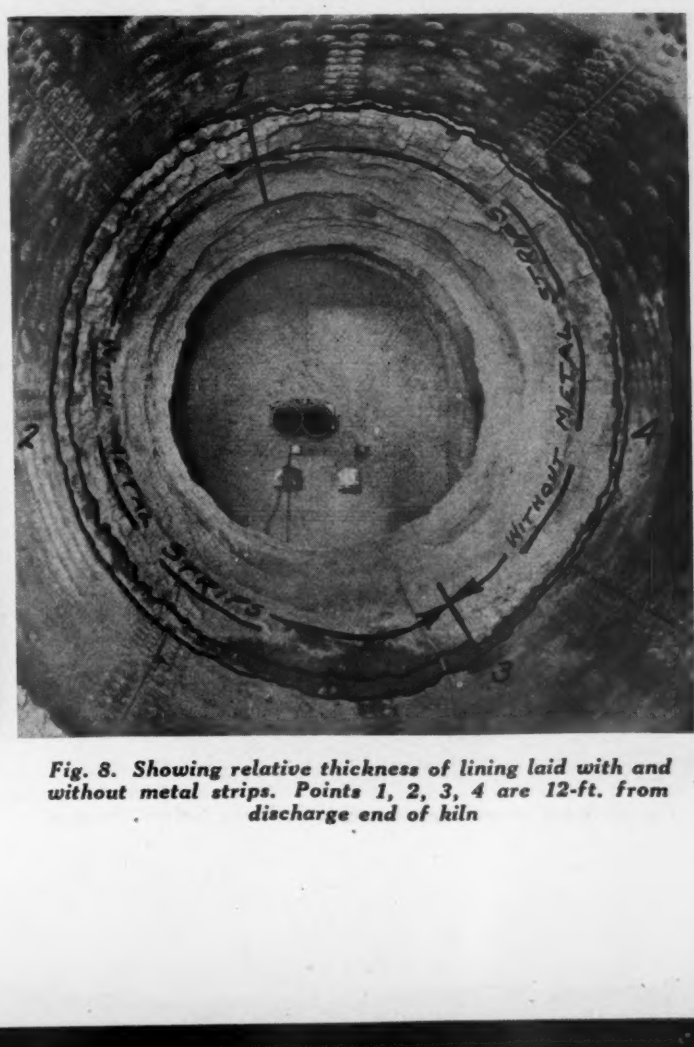


Fig. 8. Showing relative thickness of lining laid with and without metal strips. Points 1, 2, 3, 4 are 12-ft. from discharge end of kiln

alw[illegible] cooler than it had been with the older t[illegible] lining.

[illegible]nation and Permanence of Coating

[illegible]s has already been mentioned, on theo-[illegible]ical grounds magnesia brick should not be prone to take a coating. Much to our surprise, as soon as the lining was up to working temperature and the feed came down on it a coating began to form, and, what was more to the purpose, it did not fall off. Rather, it kept on building up until it was much thicker than we had ever been able to get on 70% alumina brick. The first few coatings on these have usually fallen off, and a reasonably permanent one could be had only after several days of operation.

The coating formed on the magnesia lining was quite permanent and built up to a considerable thickness as is shown in Fig. 7. Only very occasionally would enough fall off to expose the brick. When this happened the surface of the brick appeared dark and dull, in marked contrast to the shiny fused look of the other refractories.

Although no definite attempt to destroy this coating by overheating was made, it was very evident that the kiln could be run at a higher temperature than when using other linings. Many times it has been so hot that the coating on other brick would certainly have fallen off, but on the magnesia brick it was not affected.

We occasionally have rings about 50 ft. back in the kilns that call for the use of a water poker for their removal. During one of these treatments a little too much water was used, and some of it got on to the magnesia brick. The next day some small pieces of this brick came through the cooler, though the place from which they came in the kiln could not be seen. After that more care was used with the water poker and no more pieces of brick were noticed. The last use of the water poker was five weeks before failure of the lining.

Behavior of Lining

There is no special feature of operation that calls for comment except that, as just stated, the kiln could be run at a higher temperature without injury to the coating or brick. The only serious shutdown was one of seven hours, caused by the breaking of the shaft in one of the supporting rollers. The roller and its shaft were replaced by a spare unit, but during this time the kiln could not be rotated, and the lining got down to a black heat, though the load showed some redness when the kiln was finally turned over. This shutdown did not cause the loss of any coating or brick. The kiln was not at any time entirely cooled off during the life of this lining. It will be seen that this test does not tell what the behavior of these brick will be if the kiln is completely shut down and cooled off while they are in place. This point is brought out because it is reported that the failure of other magnesia linings was due to spalling after comparatively short runs.

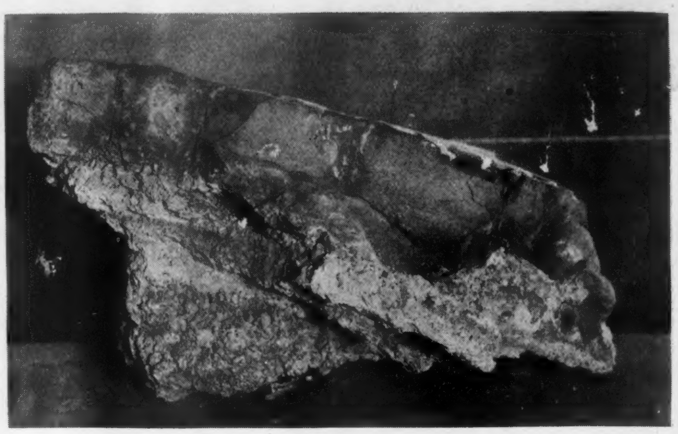


Fig. 11. Part of 3-ft. piece of lining which was broken with a sledge, showing how tightly the coating was held by the brick

About two weeks before final failure a red spot about 18 in. square appeared, but the operators succeeded in covering it up so that it cooled off. Finally one evening this same spot showed up again and rapidly became larger, and other places also became hot. The feed was shut off at once, but before the kiln could be run empty an area about 4 ft. long and taking in about one-third of the circumference of the kiln was at a bright red heat.

On entering the kiln after cooling down it was found that no lining remained in the part of the shell that had been red hot. After some cleaning out, photographs 8 and 9 were taken. It was very plainly to be seen that failure had occurred only in that half of the lining that had been laid without steel strips. The part of this half that did not fall out was very thin, while the brick that were separated by steel plates were all in place, and still retained about two-thirds of their original thickness. Without question, if separators had been used in the entire lining it would have lasted much longer. This test run has been very much worth-while in proving the value of these separators.

In order to bring out more clearly just how the steel plates helped to hold the brick in place, a number of typical specimens were arranged on a board and photographed, as shown in Fig. 10. For comparison, a few

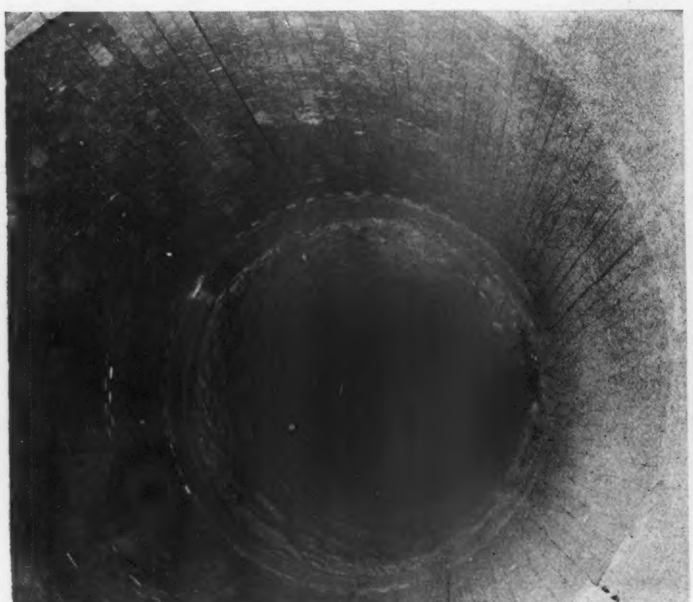


Fig. 6. View of completed magnesia lining before firing up

Fig. 7. Showing heavy coating built up on magnesia brick

unused magnesia brick are shown also. The figures under each piece show its thickness in inches.

This photograph demonstrates quite plainly two facts: first, that near the shell of the kiln, where the temperature is comparatively low, the steel separators are not altered; and, second, that near the inner surface of the lining the steel oxidizes and the oxide permeates the brick and acts as a powerful and effective bonding agent between the brick and between the brick and steel. In Fig. 10 are seen several steel plates which have so firmly united with the brick that they could not be gotten apart. Theoretically the iron oxide should lower the fusing point of the brick, and it probably does so, but it also binds them together in a solid mass and quite likely helps to attach the coating firmly to the lining. Bricks are also shown to which the plates are still firmly adhering on each side.

The heat conductivity of steel is much greater than that of brick, and it is likely that these separators help to carry heat to the kiln shell and so aid in preserving the integrity of the coating.

The coating formed on the refractories heretofore used has never been very thick, and quite commonly has fallen off when the kiln has been rotated after cooling down. The coating on the magnesia brick was so heavy and was so firmly held that before much cleaning was done a photograph of it was taken and is reproduced here as Fig. 7. Some idea of its thickness may be had when it is compared to the diameter of the kiln, which is 10 ft. inside a new lining. This coating did not fall off when the kiln was cooled down, and finally was removed manually after considerable exertion. It adhered very tightly to the brick, and the two formed practically one mass. A close-up view of a piece of coating that is still tightly bonded to the brick is shown in Fig. 11.

Fig. 9. View during removal of lining showing relative thickness of sections laid with and without metal strips. Points 1, 2, 3, 4 are 22 ft. from discharge end of kiln

Kiln Production and Fuel Consumption

The coating shown in Fig. 7 is so thick that it probably somewhat limits the production of the kiln, and means should be developed for removing a part of it without injuring the lining. Perhaps this could be done automatically by using a heat-insulating layer between brick and shell. This limitation of output apparently offsets the increase that would be expected because of the higher permissible temperature in the burning zone. This assumption is made because the production was neither greater nor less than it had been previously, nor was the coal consumption affected.

A detailed cost analysis of this experiment as compared with previous practice would involve the cost of the brick, and papers of this sort are not supposed to discuss such things. It may be stated, however, that the first cost of the magnesia lining is in excess of that of those previously used. But final comparison should be based on cost per barrel of production rather than on first cost, and these figures may be given:

LINING COST PER BARREL OF PRODUCTION, INCLUDING BOTH LABOR AND MATERIAL

Average of 27 previous linings	$0.0148
Magnesia lining	.0037
Saving in favor of magnesia	$0.0111

Since this lining produced 518,000 bbl., the saving in this instance was $5749.80. The saving so made will of course vary with the life of both the magnesia lining and the one displaced by it. If in a given plant cheaper brick last a year or more there will be less incentive to use magnesia brick than in our case, or than in any other plant in which standard linings give only limited service.

The saving of nearly $6000 just shown takes no account of the added production obtained because of the fewer occasions for re-

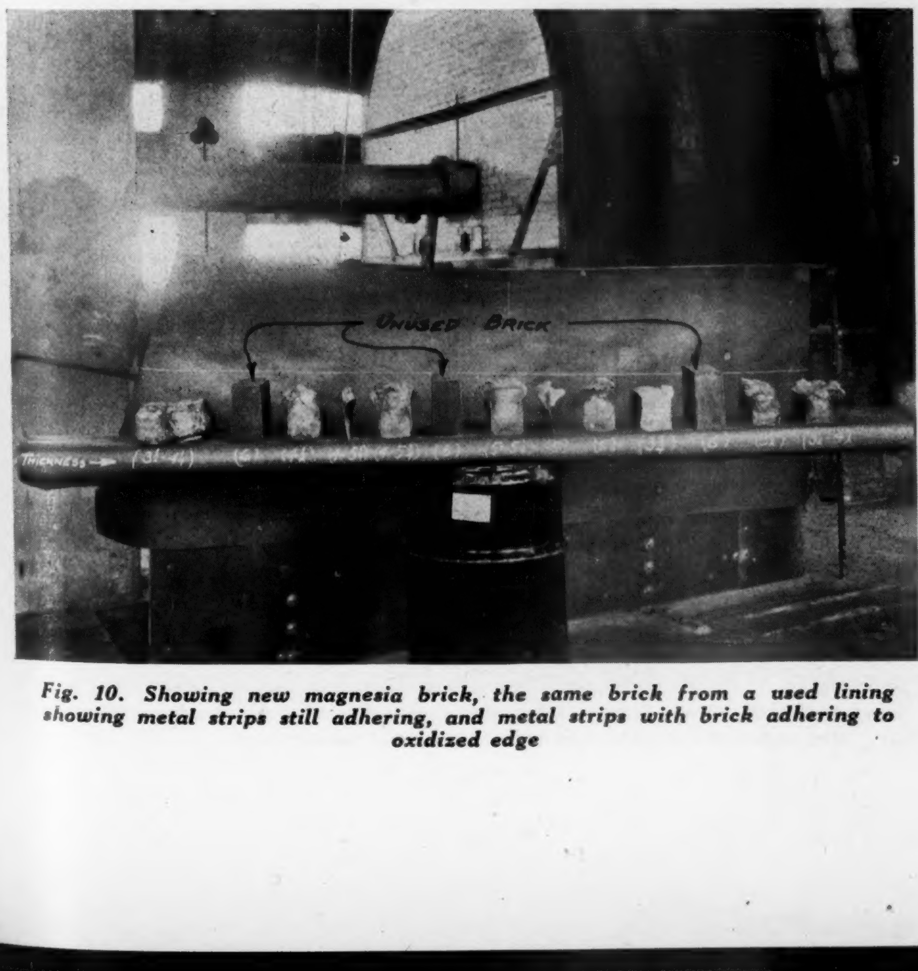


Fig. 10. Showing new magnesia brick, the same brick from a used lining showing metal strips still adhering, and metal strips with brick adhering to oxidized edge

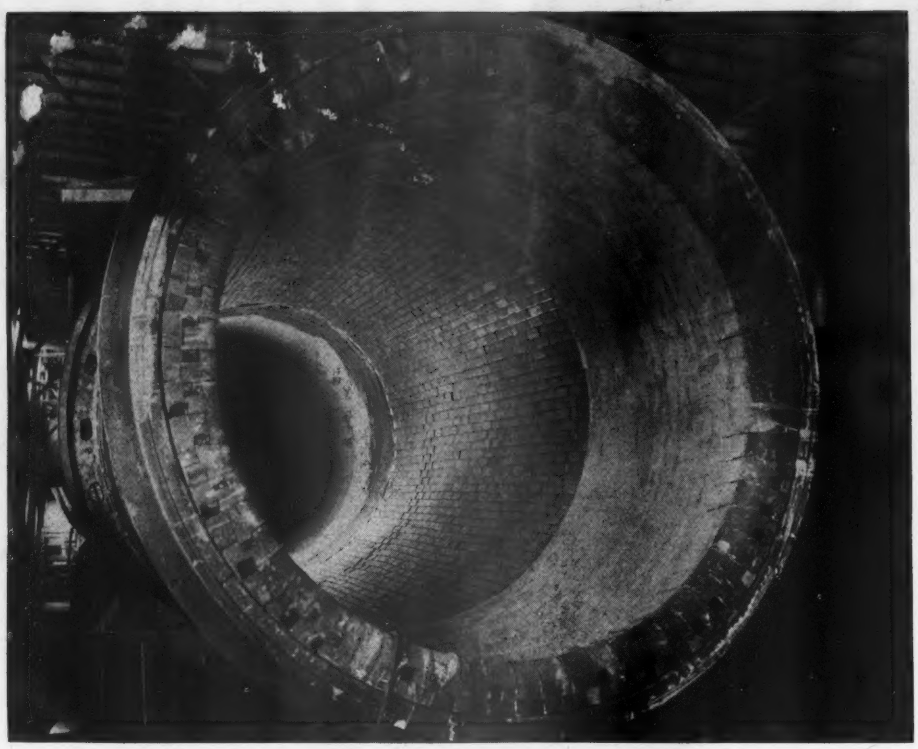


Fig. 12. Second magnesia lining laid entirely with steel plates. Note tabs holding steel separators in place between new nose blocks

newal of the lining. Under present industrial conditions this is of no particular interest, but during times of high-pressure production and the accompanying satisfactory prices, this added barrelage may be very much worth-while. In this particular experiment four shutdowns for relining were avoided. They would have meant the loss of not less than 16,000 bbl. of clinker. This saving will also vary with the relative lives of magnesia and older style brick as found by trial in any given plant.

It has already been stated that the kiln was at no time completely cooled off during this run. Consequently nothing is known as to what effect such treatment would have on this material. However, the condition of the specimen shown in Fig. 10, as well as that of other similar ones, would seem to indicate that it would withstand this treatment at least as well as the refractories previously used.

A new lining of the same make and type of magnesia brick has just been placed in the burning zone of the same kiln, but it has not yet been fired up. Steel separators were used in all longitudinal joints and paper in the transverse joints. At the same time the nose brick were renewed and some other work on the lining was done. A view of the completed job is shown in Fig. 12. The steel separators between the nose blocks can be seen, and attention is called to the tabs that are bent over to hold the plates and brick in position until the kiln is in operation. If the new lining is put in service this fall and shut down during the winter an excellent opportunity will be given to see how well magnesia brick of this type will stand a complete cooling off.

This paper is written to tell of our experience with a new type of hot zone lining for rotary cement kilns. It is admittedly the story of a single trial, with all the chance for error and discrepancy that such a trial implies, but it gave sufficient promise to warrant further experimenting, which is being done.

Bending Stresses in Wire Rope

IF the static load plus the force required to accelerate it to full speed is used in calculating rope stresses, and the sheave and drum diameters are according to practical limits, the bending stresses will be negligible as affecting the safe and economical operation of wire rope, according to an article in the October, 1932, issue of *Wire Engineering*.

The article states that existing formulas for bending stresses in wire ropes do not give correct results because of the number of variables omitted. As an example, the results obtained by different formulas for a given condition are shown, the eight usual formulas giving a variation of 91.5% in the calculated bending stresses. Some of the variables entering into the problem are the thoroughness of lubrication, shape of grooves, diameter of sheaves and drums, rope speed and method of manufacture.

When wire rope is bent around a sheave or drum there must be a relative movement of strands and wires. Thorough lubrication is important since corrosion of the wires or drying out of the hemp center affects the free movement of the wires and strands.

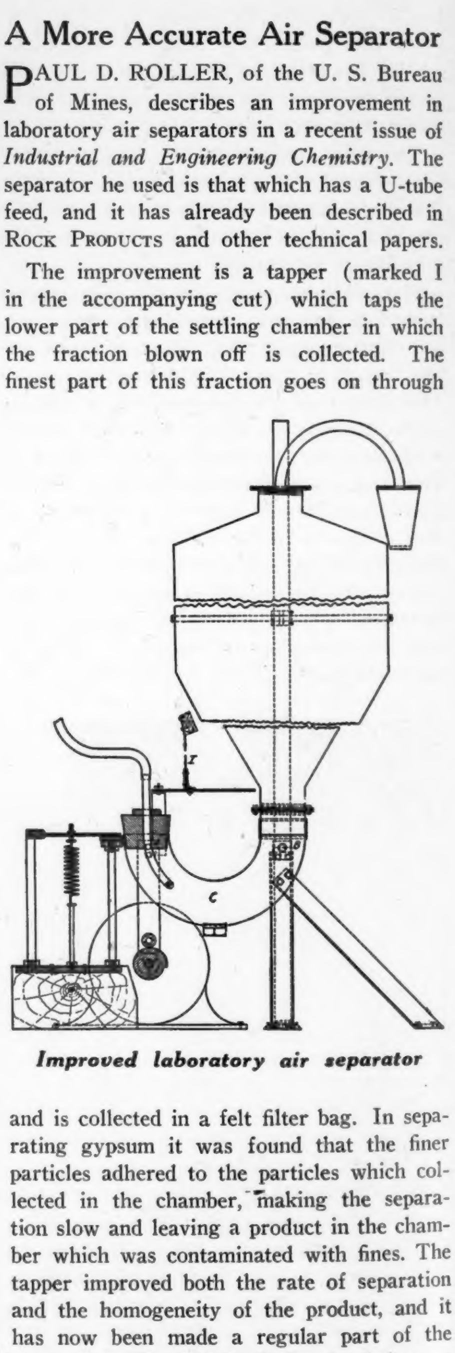
Grooves should provide a support for at least three adjacent strands and worn grooves which pinch the rope should not be used, as they prevent free bending of the rope. Small diameter sheaves, requiring greater curvature and hence greater movements of wires and strands, promote fatigue of the wires. Reverse bending, which quickly causes failure of a single wire, also reduces the life of a wire rope. Rope speed is an important factor, as the rapidity of bending materially influences fatigue.

It is also stated that in rope manufacture, the greater the machine size or capacity in tons in proportion to the rope diameter, the more uniform the rope and the higher the modulus of elasticity that can be obtained.

A More Accurate Air Separator

PAUL D. ROLLER, of the U. S. Bureau of Mines, describes an improvement in laboratory air separators in a recent issue of *Industrial and Engineering Chemistry*. The separator he used is that which has a U-tube feed, and it has already been described in Rock Products and other technical papers.

The improvement is a tapper (marked I in the accompanying cut) which taps the lower part of the settling chamber in which the fraction blown off is collected. The finest part of this fraction goes on through



Improved laboratory air separator

and is collected in a felt filter bag. In separating gypsum it was found that the finer particles adhered to the particles which collected in the chamber, making the separation slow and leaving a product in the chamber which was contaminated with fines. The tapper improved both the rate of separation and the homogeneity of the product, and it has now been made a regular part of the apparatus. The U-tube feeder is shaken up and down by a cam, as shown, and the same motion operates the tapper which is attached to the U-tube frame.

Rules Gravel Pits May Not Be Condemned for State Use

THE NORTH DAKOTA state highway department had no right to condemn the gravel pit on the Lowe farm near Forest River for the purpose of securing a supply of gravel for state highway purposes, declared the North Dakota supreme court in a recent decision.

The case originated in Walsh county when the highway department sought to get control of the gravel supply on the Lowe farm, as reported in the July 16 issue of ROCK PRODUCTS.

Previous to the commencement of the proceedings, the property was leased by the Becker Sand and Gravel Co. of Detroit Lakes, Minn. This company brought an action in the Walsh county district court to restrain the proceedings of the highway department. The case was heard before Judge W. J. Kneeshaw who held with the company and issued a restraining order against the highway department. An appeal was taken to the supreme court.

In the meantime the highway department reached a satisfactory agreement with the company and the contract for the graveling of No. 44 was let.

The court ruled the provision in section 20, of chapter 159, laws of 1927, violates section 14 of the North Dakota constitution which provides that "private property shall not be taken or damaged for public use without just compensation having been first made to, or paid into court for the owners."

Chief Justice A. M. Christianson, in the opinion for the supreme court, said "section 14 of the constitution was intended to guarantee to an owner of property the full right of ownership including possession and enjoyment, rather than a right to redress for wrong committed in taking his property away from him."

The court ruled that although the provisions in question of section 20 are in violation of the constitution, the rest of the statute still remains effective.—*Grafton* (N.D.) *Record.*

Completes Insulated Steel House

THE Insulated Steel Co., of Cleveland, Ohio, has completed the construction of an insulated steel house which, it hopes, may point the way to cheaper and better homes.

From the standpoint of the rock products industry this type of house will replace very materially the volume of materials now required in the construction of homes. For many years schemes to develop a type of construction suitable for mass production methods have been investigated and as yet little success has been demonstrated. Undoubtedly there is room for improvement in the present system whereby homes are made available to prospective owners, but there are many who contend that greater problems exist than to perfect a method of turning out homes by the million. In fact, some feel that this application of mass production, with elimination of individuality in the home, might have more serious results than those benefits which might be realized.

Rock products producers will be interested in the application of their materials in the house being built by the above company. The chief use of such materials is as lath and plaster, gypsum lath and plaster being used on the inner walls. An acoustical tile is used on some of the ceilings, and a 2-in. slab, presumably either gypsum or concrete, is used for the roof.

Foreign Cement in Seattle

A PROPOSAL to repeal restrictions by which foreign cement is barred from use in work for the city of Seattle, Wash., has been made by a councilman as a result of an increase in the price of cement, the *Seattle Post-Intelligencer* reports.

In commenting on the proposed change Mayor J. F. Dore said: "I am in favor of giving employment to our home people, not to those in foreign countries. Unless I can be shown that cement prices here are excessive I will veto an ordinance letting in the foreign products."

American Asbestos Industry Pictured as Not Very Productive

THE United States Tariff Commission heard testimony October 7 that the Arizona asbestos mines could not produce more than 1% of the domestic consumption.

Sam Dolbeare, mining engineer, told the commission, which is investigating alleged unfair competition in the sale of Russian asbestos in the United States, that in 1921 and 1922 when crude asbestos prices ranged from $2000 to $3000 a ton, the Arizona mines were producing 1000 to 1200 tons or less than 1% of the domestic use.

In 1928, when asbestos prices again reached a high point, ranging from $800 to $1000 a ton, the Arizona mines produced about 1200 tons, he said. "It is my opinion," he added, "that this is the limit of expectancy of these operations."

The witness testified that he made an examination of the Arizona mines in the fall of 1931 and that he found that the Bear Canyon mine had only about 1000 tons of production left. Later, he said, he visited the Regal mines and found them closed.

Mining at both of these operations, he said, is done by hand methods. The equipment is small; it is "minute" in comparison to Canadian operations, he declared, adding that he regards as "impossible" the production of 3500 tons annually in Arizona mines.

He stated that his survey of the Arizona mines was made at the request of the Amtorg Trading Co. and that his company, Stuart James and Cook, rendered technical assistance to the Russian soviet government in the Donetz coal basin. Mr. Dolbeare testified that he was a member of the Canadian National Research Council in 1926.

C. H. Carlough, president, Carolina Asbestos Co., testified that he was informed in the trade that deliveries are "easy" when the market price drops. Vermont asbestos did not compare with the lowest grades of Canadian, and the Russian is inferior to the Canadian, he said.

RETAIL MATERIAL PRICES, DELIVERED, OCTOBER 1, 1932 (COMPILED BY DEPARTMENT OF COMMERCE)

City	Portland cement, per bbl. exclu. of cont.	Gypsum wallboard, ⅜-in., per M	Hydrated lime, per ton	Building sand, per cu. yd.	Crushed stone, ¾-in., per ton	Gypsum plaster, neat, per ton
New Haven, Conn.	$2.40	....	$25.00	$1.25	$2.00	....
New London, Conn.	2.40	$25.00	18.00	1.00	2.00	18.00
Haverhill, Mass.	2.60	25.00	16.00	......	......	17.00
New Bedford, Mass.	2.45	25.00	16.00	1.25	2.50	16.00
Albany, N. Y.	2.70	23.85	15.75	......	......	16.20
Buffalo, N. Y.	2.95	21.00	18.00	2.50	2.05	16.00
Poughkeepsie, N. Y.	2.50	35.00	18.00	2.25	2.00	13.00
Rochester, N. Y.	2.28	22.00	14.50	2.00	2.40	16.00
Syracuse, N. Y.	2.60	20.00	....	1.80	1.50	14.00
Paterson, N. J.	2.00	24.00	18.00	1.50	2.10	17.50
Trenton, N. J.	2.10	28.50	13.25	1.10	1.05	15.50
Philadelphia, Penn.	2.24	....	12.50	1.65	2.40	15.00
Scranton, Penn.	2.40	30.00	18.00	1.85	......	18.00
Baltimore, Md.	2.10	25.00	13.00	1.85	2.50	15.50
Washington, D. C.	2.10	22.50	11.00	......	......	13.00
Richmond, Va.	2.80	38.00	20.00	1.50	2.25	18.00
Fairmont, W. Va.	2.50	35.00	16.00	2.50	3.25	17.75
Columbia, S. C.	2.50	45.00	14.00	1.50	2.25	17.00
Atlanta, Ga.	2.75	....	....	3.38	2.50	18.00
Tampa, Fla.	2.80	50.00	24.00	2.00	3.50	20.00
New Orleans, La.	2.65	37.20	14.00	2.75	......	18.00
Shreveport, La.	3.00	40.00	20.00	1.50	3.25	20.00
Erie, Penn.	$1.90	$22.50	$13.50	$1.75	......	$15.00
Akron, Ohio	1.81	40.00	13.50	1.50	$2.25	15.50
Cleveland, Ohio	1.80	21.00	12.00	1.28	2.20	18.00
Columbus, Ohio	2.00	....	14.00	1.22	......	16.00
Toledo, Ohio	1.92	21.00	14.00	1.75	2.25	14.00
Detroit, Mich.	2.00	25.00	12.00	2.03	1.75	13.00
Lansing, Mich.	2.25	....	20.00	1.80	1.80	17.50
Saginaw, Mich.	1.85	20.00	16.00	2.50	2.20	16.00
Terre Haute, Ind.	2.20	28.00	18.00	1.25	3.00	18.00
Louisville, Ky.	1.60	45.00	12.00	2.00	2.05	16.00
Milwaukee, Wis.	1.48	22.00	14.00	1.25	1.25	15.20
Des Moines, Iowa	1.82	....	....	......	......	14.00
Kansas City, Mo.	2.20	25.00	22.00	1.82	1.88	17.00
St. Paul, Minn.	2.10	23.00	19.00	1.25	1.75	17.00
Grand Forks, N. D.	3.00	23.00	19.00	1.25	1.75	17.00
Sioux Falls, S. D.	2.00	22.00	20.00	1.25	1.75	15.50
Wichita, Kans.	2.15	25.00	22.50	1.00	......	15.50
San Antonio, Tex.	2.55	39.00	17.50	1.75	2.25	18.15
Tucson, Ariz.	3.29	45.00	28.80	1.00	2.25	17.10
Los Angeles, Calif.	2.30	23.50	24.70	1.25	1.40	16.15
San Francisco, Calif.	2.60	45.00	22.50	1.40	1.60	17.30
Seattle, Wash.	2.70	....	....	......	......	....

Removal of Shale and Soft Stone from Gravel

By C. S. Huntington
Engineer, Link-Belt Co., Chicago, Ill.

THE REMOVAL of shale and soft stone from gravel used for concrete highway work has become more and more of a problem to many producers in most sections of the country.

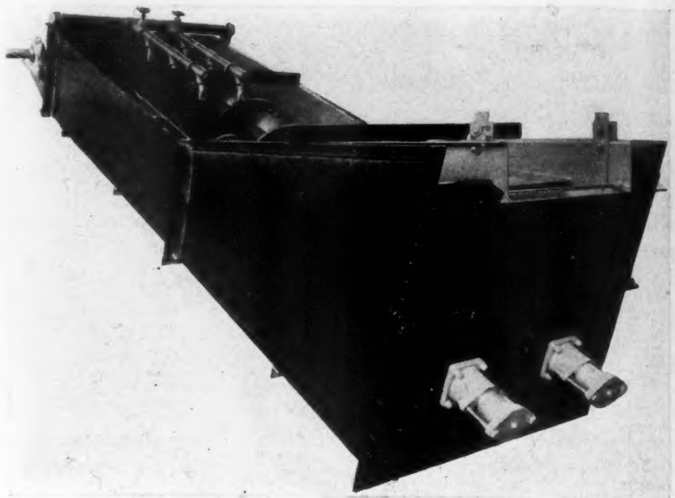
Many efforts have been made for several years to solve this problem—with satisfactory results in only a few cases. The great variation of materials has made it seem that no one type of machine can be used to cover all cases and that each pit or plant must have an individual study made of the material found at that particular location.

Use of Jigs

One of the first types of machines which was tried for this work was some form of jig similar to the ones in use in washing coal. In coal washing the problem is to remove slate and similar comparatively heavy materials from good coal, a comparatively light material. The heavy slate forms a bed over the bed plate of the jig and remains on the bed plate rather a long time because of the small quantity in the total product. The light coal rises to the top of the bed during the jigging and passes off freely in large quantities.

In handling gravel the process is reversed. The heavy gravel forms the bed and is the larger quantity, while the lighter shale and soft stone rises to the top in only a very small quantity and passes off slowly, or intermittently. The first thing encountered in adapting a coal jig is to so arrange the take-off gates that the heavy bed can pass off rapidly and the lighter shale be held until sufficient quantity collects to allow it to pass off from the top without carrying too much good gravel with it.

While two distinct layers or strata of gravel and shale are formed on the jig bed, it is difficult to keep them separate at the discharge point, because of the rapid movement of the large quantity of gravel and the slow movement of the small quantity of shale. Some shale will mix with the gravel as it passes through the discharge openings.



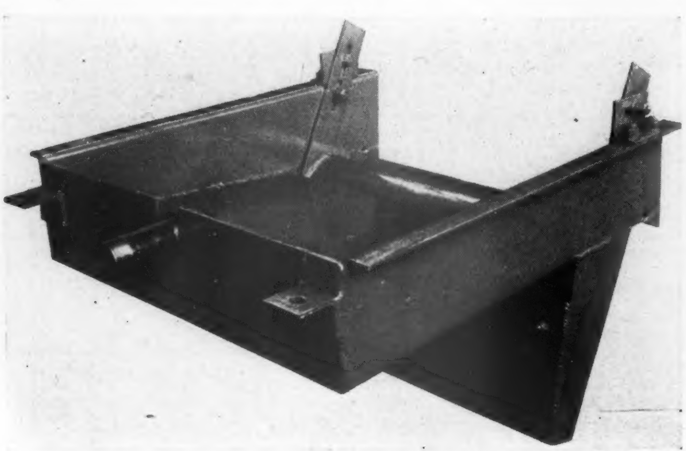
Double screw gravel washer equipped with de-shaler

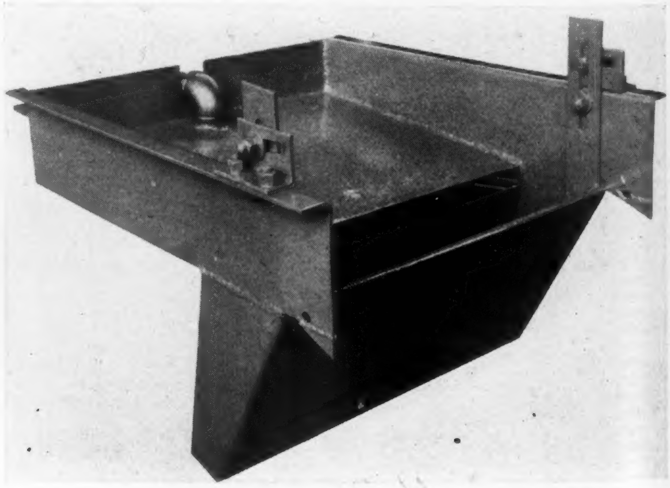
In experiments conducted some eight or 10 years ago a full size Shannon type of jig was installed at a gravel plant located in Iowa. The tests were run intermittently for a period of several months.

First it was found necessary to alter the discharge openings to take care of the rapid movement of the gravel across the bed plate without disturbing too much the stratification. Then it was found necessary to keep the size of material fed to a single jig limited to pieces of approximately the same size. That is, results could not be obtained on a feed of ¼-in. to 2½-in. material, but when the material was screened so that the feed to the jig would be ¼-in. to ¾-in. or ¾-in. to 1½-in. or 1½-in. to 2½-in. results could be obtained.

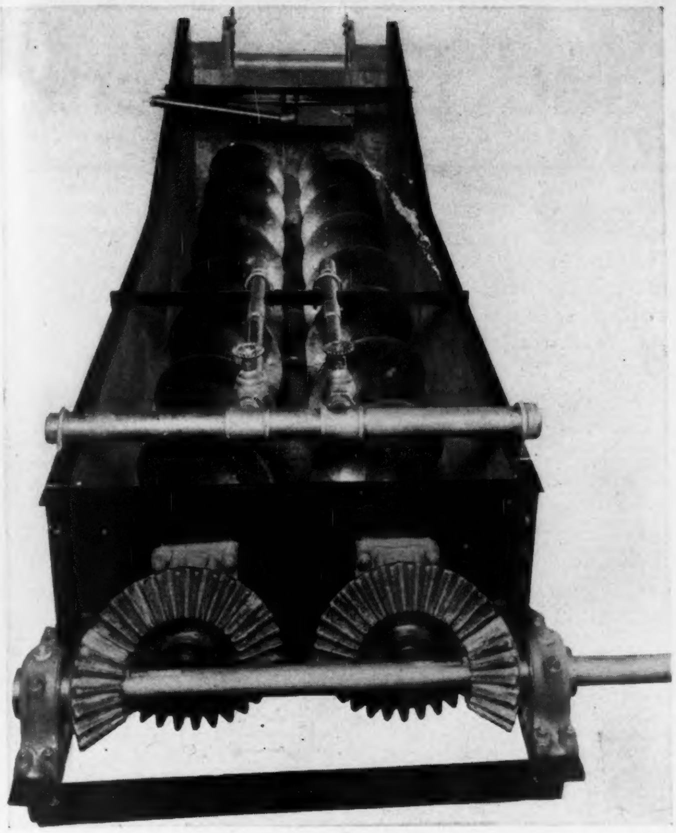
It was also found necessary to keep an almost uniform flow of material to the jig or the bed would become disturbed. A uniform flow from most pits is not possible because the material in the pit itself is not found in uniform percentages. It then became necessary to have an operator watch the feed and the bed of material and adjust the discharge gates to the flow of material.

The jigs in use at that time, including the Shannon type used in the experiment, were all of the plunger type and have one fault due to the back suction caused by the plunger. Since that time there have been introduced jigs operating under English pat-





Two views of de-shaler for removing shale, waterlogged wood, etc.



View of screw washer and de-shaler from drive end

ents which use compressed air in place of mechanical plungers and eliminate the back suction. Experiments are going forward now on this type of jig.

The operation of a jig depends upon the difference in specific gravity of the good gravel and the shale or soft stone. This accounts for the varying results obtained in different parts of the country with different jig installations.

The good gravel seems to have an average specific gravity of from 2.5 to 2.7, while the shale seems to run from 1.5 to 2.5 specific gravity. A jig separation cannot be made accurately unless there is apparently a difference of about 0.5 or more between the specific gravities of the materials to be separated.

Hydraulic Separation

The next type of machine used for this class of work utilized water currents in a tank of water with a mechanical device for lifting the good gravel from the tank while the water carried away the shale and soft stone. The water currents may be vertical rising currents or horizontal currents or a combination of the two.

There are rather a large number of such machines in use, the more common form being a steel tank in which is suspended an adjustable receiving box which controls the direction of the rising currents and the overflow water. In the lower part of the tank are one or two screws to remove the good gravel. Such a machine is shown in the illustrations. These depend both on specific gravity and on the shape of the particle for their operation. Thesr machines make an excellent separation on some materials, but in other cases only a partial separation results, but even this partial separation is justified under present specifications in many installations.

Use of Breaker Plates

More recently there have been put on the market devices to break up the soft stone and shale by throwing the gravel against a breaker plate so that the pieces to be eliminated can be broken up and removed. There are two types available. One consists of a revolving horizontal disc inside a housing. The material is fed to the revolving disc and is thrown by centrifugal force against the housing which forms a breaker plate. The other type is similar to a hammermill except the hammers have been replaced by two vanes which rotate on a horizontal shaft. Material is fed into the top and one of the vanes hits the material and throws it against the breaker plate on the end of the housing.

Results from these machines can no doubt be obtained on some materials, but on other material the soft particles will bounce off the breaker plates like rubber balls, while the good gravel, if a little brittle, will be broken up.

Other Types

There is also a variation of a ball mill which grinds up the shale and soft stone. There are not enough installations in use at this time to tell what the results will be or how much good gravel will be ground up.

So far experiments and installations lead one to believe that no single machine will be able to take care of the accurate removal of shale and soft stone. A combination of a device to break up the soft particles and a water current type machine to finish the work will no doubt be the logical solution. In some cases a screen may be used in place of the water current machine where the soft stone can be broken down to fine enough particles. Experiments are now being carried on with a selective crusher to break up the soft material and leave the good gravel. This to be followed by a rising current machine or screen to remove the broken particles. This method will not break up brittle gravel and so far promises to give better results than any other type. These experiments are not far enough advanced to place a machine on the market, but real progress is being made.

Magnesite Processing

THE plant and processing methods of the Sierra Magnesite Co., Ltd., San Francisco, Calif., are described in an article in the August issue of the *Engineering and Mining Journal.*

The new calcining plant, completed in November, 1931, is located about 16 miles west of Ingomar, Calif. A vein of magnesite, ranging from 2½ to 12 ft. thick, is mined, crushed down to ¾ in. and under, and calcined in a rotary kiln. About 35 men are engaged in the mining operation and six in crushing and calcining.

The material is crushed by a 10- by 20-in. jaw crusher and a 2-ft. Symons cone crusher and screened by two 3- by 6-ft. Symons rocker screens. The principal impurity, silica, is segregated out with the fines by the screening operations. The crushed and screened raw material is stored in a 7-compartment 2000-ton bin from which it is fed and proportioned by Hardinge constant weight feeders and conveyed to a feed bin at the kiln.

Calcining is done in a 6-ft. by 100-ft. oil-fired rotary kiln which is lined with 9-in. periclase brick in the 40 ft. high temperature zone. A maximum temperature of 1760 deg. C. is used to produce periclase and 1200 deg. C. to calcine plastic magnesite. Thermocouples are used in the hot zone of the kiln and in the stack. The kiln has an output of about 100 tons per day.

The calcined material is passed through a 4- by 40-ft. rotary cooler and elevated to a set of six steel tanks with storage capacity of about 2000 tons. From these it is trucked to a railroad loading plant at Ingomar.

At this loading plant the trucks are dumped to a hopper and the material carried up to steel storage bins by means of a bucket carrier which passes over and under the bins. Material drawn from the bins is elevated by the carrier system and spouted to cars or may be discharged to a 5-roll high-side Raymond mill for fine grinding.

The pulverized material, air classified to a fineness of 95% minus 200-mesh at the rate of 1½ to 2 tons per hour, is conveyed to storage bins from which it goes to bagging machines for packing in paper or burlap bags. The conveying equipment was furnished by the Link-Belt Co. and United States motors are used.

Three grades of plastic magnesite are made containing 97%, 95% and 87% magnesium oxide. Also, two grades of artificial periclase are made, one containing 95% magnesium oxide and not over ½% iron, and the other 92% magnesium oxide with not over 1% iron. The periclase products are used for electric furnace linings and in the manufacture of high-grade refractories.

New Machinery and Equipment

"Dry Cleans" Granular Material

THE Blaw-Knox Co., Pittsburgh, Penn., announces an entirely new piece of equipment, the Blaw-Knox "De-Duster." Any granular substance, such as coal, sand, gravel, crushed rock, etc., smaller than 1 in. in size, can be de-dusted in this apparatus, the manufacturer states.

The material to be de-dusted is dropped through the top inlet into the upper hopper. At the bottom of this hopper the material is passed through two annular openings, which shape it into two cylindrical curtains about 3½ in. apart. These two curtains fall past the upper adjustable air nozzle where they are partially de-dusted. After passing the upper air nozzle, the material falls into a second, or intermediate hopper, whence it passes over a cone, again being shaped into a cylindrical curtain. As the material changes the direction of its flow from that of the slope of the second hopper to that of the slope of the cone at the base of the second hopper, it is turned over, thus presenting a new face to the second air stream through which it now passes in the form of a cylindrical curtain. This second air stream, coming from the lower adjustable air nozzle, is said to complete the de-dusting of the material.

The de-dusted material then passes into the third, or lower, hopper, whence it is drawn off as needed.

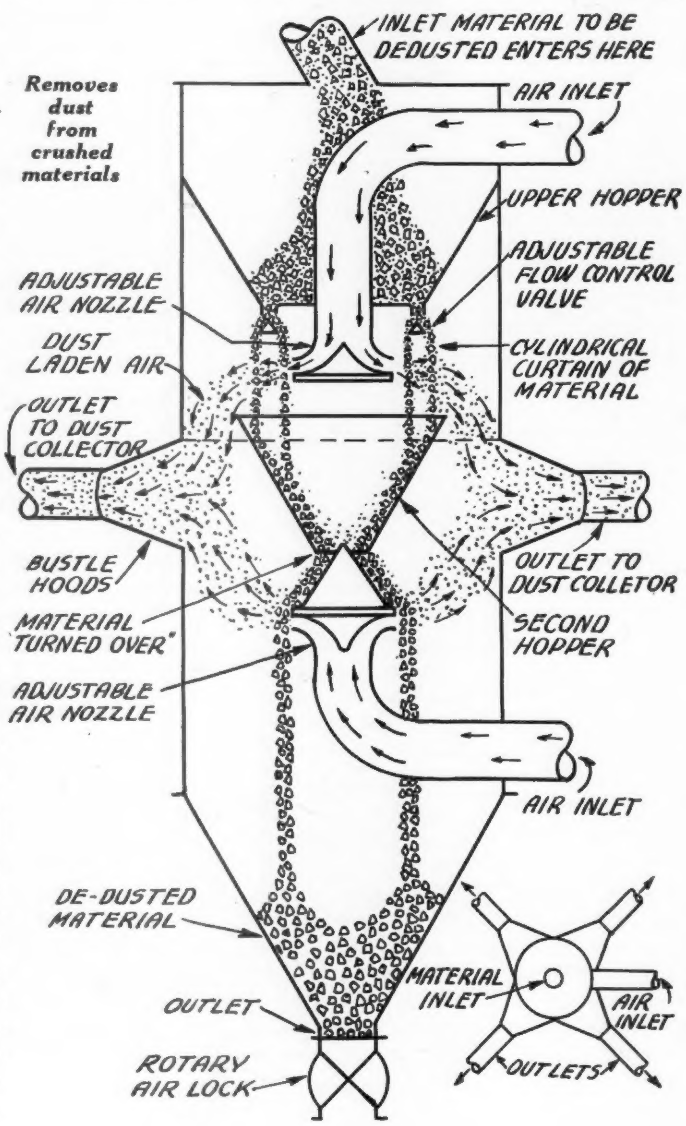
The dust and fines, which have been removed from the material, are carried off by the two air streams through the "bustle" hood to the four outlet pipes, thence to a Blaw-Knox Framed Bag Dust Collector, where the dust is graded and completely collected in a dry usable form. After the air has been through the dust collector it may be exhausted into the atmosphere or returned to the De-Duster for further use in this operation.

The flow of material from the first hopper of the "De-Duster" is controlled by the adjustable gate. This adjustment is to allow for different gradations in the sizes of materials. The two air valves are also adjustable. With these three adjustments, the "De-Duster" can be set to remove anything from minus ten mesh down to the finest dust, the manufacturer states.

All parts subject to abrasion are a minimum of ¼ in. thick. In addition to this, where special conditions require it, the unit can be completely lined with rubber or composition lining for the dual purpose of further resisting abrasion and preventing contamination by the steel of the material passing through.

Two features are claimed for this cleaning equipment: It imparts two cleaning operations in one pass of the material; and being a dry process, it presents both the cleaned material and dust in a readily handled, marketable condition.

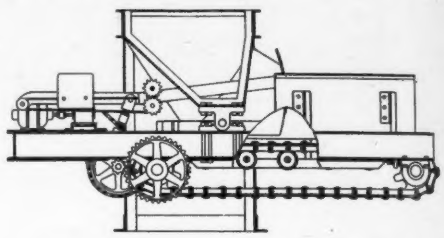
It is furnished in capacities ranging from 25 tons per hour to 150 tons per hour.



Removes dust from crushed materials

Constant Weight Feeder

TWO NEW TYPES of crusher constant weight feeders are announced by the Hardinge Co., York, Penn. The types have been developed to take feed as large as 2 ft. in diam. and to prevent clogging in the bin, the manufacturer states. They are furnished with either rubber belt or armored apron.



Takes feed up to 2 ft. in diameter

These feeders measure by weight and a record of material entering production can be made at the beginning of plant operations. It is said to be 99% accurate.

They consist of a traveling belt mounted on a frame on which the driving mechanism is also located. It is so suspended that any variation in the weight of the belt opens or closes the feed gate. The weight of the material released to the crusher is said to remain constant no matter how conditions change.

Monarch Manufacturing Co., Inc., Expands

THE Monarch Manufacturing Co., Inc., Wilmington, Del., announces it has acquired the property, plant and equipment formerly owned and operated by the Remington Machine Co., and that it is now equipped to do any class of light or heavy machine work. It is also manufacturing a line of rock crushing and sand and gravel equipment, as well as snow plows and chip spreaders.

Earle S. Philips heads the executive and sales departments, and associated with him in these departments are J. W. Kitts, John M. Bishop, P. D. Frack, F. H. Greaney, F. J. Pratt and G. W. Kerr. Harry E. Kind is in charge of the factory and engineering departments, and associated with him are L. M. Brooks and several others formerly in the employ of the Good Roads Machinery Co.

Sharpener for Well Drill Bits

THE WD sharpener for well drill bits is announced by the Ingersoll-Rand Co., New York City. With this sharpener new bits can be forged on blank steels in two or three heats, and dull bits can be redressed in one heat, the manufacturer states. It is claimed to make perfectly formed bits which are concentric with the steel and accurate in gage and other details. Bits up to 9 in. in diam. on 6-ft. by 4½-in. steels can be made on these sharpeners.

Has wide range of application

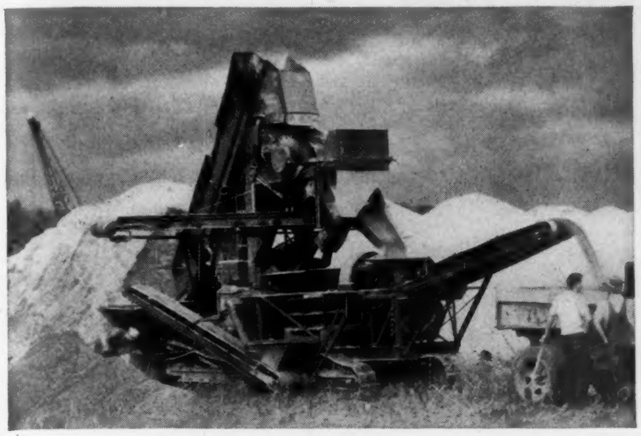
Advantages claimed for this sharpener include: Fewer steels per drill required; saving in the purchase price of steel; small floor space requirements; operates entirely by compressed air; all operations are controlled by one throttle; and water swages are used to open the channel to the desired shape.

Acetylene Association to Meet

THE ANNUAL MEETING of the International Acetylene Association is to be held in Philadelphia, Penn., November 16-18. A feature of the program will be an industrial drama portraying the technical and practical factors of plant rehabilitation in the industrial field under today's economic conditions. A strong program has been prepared and all sessions of the convention will be open to any interested individual.

Screening and Crushing Plant

A PORTABLE crushing plant is announced by the Barber-Greene Co., Aurora, Ill. When used in conjunction with its standard bucket loader with vibrating screen the two units form a complete excavating, screening, crushing and loading plant that is self-propelled and portable. Small plants of this character have been used by established operators to meet roadside competition in a number of localities, the manufacturer states. They have also proved of value about some plants for rescreening and recrushing requirements.



Does a complete job of crushing and screening

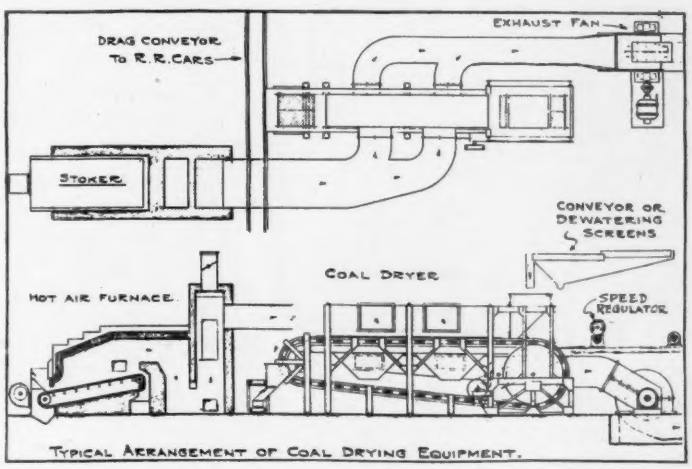
The plant can work directly into the bank or into the stockpile. The spiral feeder carries the material to the buckets which elevate it and discharge to the double-deck vibrating screen. The oversize passing over the screen flows through a gravity chute to the crusher. The crushed materials are sent back to the feeding end by a belt conveyor on the crusher unit. The material that passes the top deck and not the second deck flows down to the hopper of a conveyor that carries the correctly sized material out to the trucks. The fines passing the second deck are carried to one side by a cross conveyor that is a part of the screening unit.

Where only screened material is required the bucket loader and screen do the work, and if only bank-run material is wanted the screen drive may be disconnected and a veil plate placed over the top deck.

Drying Equipment

A NEW DRYER for natural mineral and industrial products is announced. This dryer, known as the "D.O.L.," is built by the Sintering Machinery Corp., but will be distributed by the Oliver United Filters, Inc., New York, N. Y.

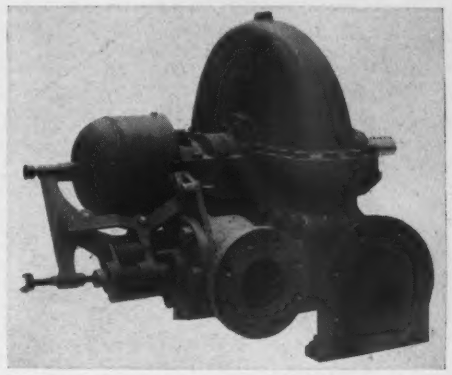
Operating on the principle of a straight line traveling bed, the wet material is dried by controlled passage through it of heated air or gases. Dusting and breakage of materials do not occur with this dryer, it is claimed, and power requirements and heat required for drying are low, the manufacturer states.



Typical Arrangement of Coal Drying Equipment.

Mechanical-Drive Turbine

A NEW mechanical-drive, non-condensing steam turbine for driving centrifugal pumps, fans and other rotating equipment has been developed by the General Electric Co., Schenectady, N. Y. This turbine is suitable for driving equipment at speeds from 1200 to 4000 r.p.m. and is available up to 250 hp. under suitable steam conditions. The new turbine is a single-stage machine with two rows of revolving buckets.



Easy access is provided

The wheel casing is split horizontally to allow easy access to the internal parts, and the steam and exhaust pipes are connected to the lower half of the machine. A centrifugal governor, with weights pivoting on knife edges, provides speed regulation.

Improves Steam Pumps

AN IMPROVED LINE of steam pumps is announced by the Worthington Pump and Machinery Corp., Harrison, N. J. This line of horizontal duplex steam pumps is especially adapted to handling hot or cold oils, gasoline and other petroleum products. Outstanding features of these pumps is the adoption of stainless steel drop forged valve service, as well as the submerged piston type of construction on all models.

THE INDUSTRY

Incorporations

Herkimer Quarries, Newport, N. Y., $20,000.

Dow Brick and Tile Co., Inc., Detroit, Mich., $100,000, 2000 shares common.

Spruce Pine Mica, Inc., Spruce Pine, N. C. S. B. Cannon and F. R. Shaffer.

Dorwin Springs Sand and Stone Co., Syracuse, N. Y., reduced capital from $100,000 to $50,000.

Hudson Valley Quarries, Yonkers, N. Y., $10,000. A. H. Garnjost. To produce sand, gravel, etc.

American Cement Holding Co., Phoenix, Ariz., 600,000 shares of no par value. Wayne Hubbs and J. Novis.

Concrete Materials Co., Wilmington, Del., 1200 shares common. To produce sand, gravel and crushed rock.

Texas Osage Minerals Co., Oklahoma City, Okla., Ernest R. Chamberlain, 1012 W. 21st St., Oklahoma City.

Brooklyn Heights Sand and Gravel Co., Independence Village, Cuyahoga County, Ohio, 25 shares of no par value.

Inland Quarries Co., Inc., Gosport, Ind. O. J. Miller, G. C. Moore and Nelson Gorsuch. To deal in stone for building purposes.

Mid-State Sand and Gravel Co., Fairview, Okla., $5,000. H. L. Rimmer, L. B. Rimmer, Fairview, and N. L. Harkey, Oklahoma City, Okla.

Chicago Builders' Material Co., 1233 S. Wabash Ave., Chicago, Ill. Wm. E. Dee, Geo. W. Dee, S. A. Dee, S. R. Dee and J. H. Vail.

Cahokia Sand and Materials Co., East Carondelet, Ill., $20,000. J. A. Ward, L. K. Sager and Chas. H. Lund. To deal in building materials.

Rensselaer County Stone Products Co, Troy, N. Y., $50,000 preferred stock and 500 shares common. J. Winston, 8 W. 40th St., Manhattan, New York City.

Verna Products, New York City, 200 shares common. Hays, St. John, Abramson & Schulman, 43 Exchange Place, New York City. To produce building materials.

F. & M. Sand and Gravel Co., Burlington, Mass., $10,000; 1000 shares $10 each. President, James H. Mohan; treasurer, Harry Friberg, 99 High St., Winchester, Mass., and Mary M. Mohan.

Quarries

Burbank Rock Products Co., Van Nuys, Calif., has been granted a permit to build a rock bunker at its plant there.

Bluffton Stone Co., Bluffton, Ohio, is building a siding from its plant to the main line of the Nickel Plate railroad.

New Haven, Mo. The state rock crusher used in road maintenance work in this vicinity was destroyed by fire recently.

Puente, Calif. Mrs. Maude M. Talbert has been granted a permit to erect and operate a rock-crushing plant in Baldwin Park.

Richmond, Mo. The rock crusher which has been operating on the W. Johnston farm has been shipped to Springfield by the Gilloiz Construction Co.

Central Kansas Quarries Co. has started production of crushed stone at Ottawa, Kan. Two shifts are now working and a third shift may be added, it is reported.

Baker and Tobin, contractors for road improvement at Cambridge, Ohio, will crush stone for this work in Guernsey county. Leases have been signed and crushers will be installed immediately.

La Crosse, Wis. Whether LaCrosse county will operate quarries this winter for road work will be decided at a meeting of the Wisconsin highway commission and the county highway committee soon.

Iron and Steel Products, Inc., Chicago, Ill., has purchased for dismantling the blast furnace plant of the Youngstown Sheet and Tube Co. at Mayville, Wis. The iron mine and quarry part of the operation were disposed of about a year ago to the same company.

Sand and Gravel

Pioneer Sand and Gravel Co., Seattle, Wash., has purchased an additional site for future development of its Fairview plant.

United Materials Corp., Milwaukee, Wis., has abolished its trucking service. On small orders where the purchaser has no truck the company will arrange for trucks.

Construction Materials Co. reports shipping a record amount of material in September from its Ferrysburg, Mich., plant.

Cement

St. Mary's Cement Co., St. Mary's, Ont., reopened its plant the middle of October.

Riverside Portland Cement Co. reopened its Ora Grande, Calif., plant early in October.

Lehigh Portland Cement Co. expects to reopen its New Castle, Penn., plant November 5.

Signal Mountain Cement Co., Chattanooga, Tenn., planned to resume operation on a 60% basis about November 1.

Geneva, Ohio. Truck delivery of cement by all manufacturers serving this area has been discontinued. Shipments will be made by railroad only.

Universal Atlas Cement Co. has resumed production of unit No. 6 at Buffington, Ind., which has been closed since April. It is expected that production will be continued well into the winter.

Keystone Portland Cement Co., Bath, Penn., has had equity proceedings asking for a receivership discontinued. The plaintiffs have found the affairs of the company in a satisfactory condition, it is said.

Superior Portland Cement, Inc., started operation of its entire plant at Concrete, Wash., early in October, about one month earlier than contemplated, when the plant was first closed. The early opening resulted from an order of a large quantity of "Hyurly" cement.

Silica

Eastern Silica and Chemical Corp., which has been in the hands of the receiver, is defendant in a suit seeking dissolution of the company.

Other Rock Products

Savannah Kaolin Co. has renewed its lease on the plant at Gordon, Ga., to Peter W. Martin, Inc.

Industrial Minerals Corp., Franklin, N. C., plans development of its cyanite property in Macon county.

Franklin Mineral Products Co., Franklin, N. C., is planning to establish a European sales office in England.

Ozark Chemical Co., Tulsa, Okla., will construct a sodium sulphate plant in Ward county, Texas, to cost $350,000.

Minnesota Mining and Manufacturing Co. plans new construction to its properties in St. Paul, Minn., and Wausau, Wis., to cost $100,000.

Kenosha, Wis. A shipment of 500 tons of potash salts from Germany has been received here, the first all water shipment to this point.

Raleigh, N. C. H. J. Bryson, state geologist, reports increased strength in the mica market, with shipments showing a noticeable increase.

Manhattan, Mont. The first load of onyx has been shipped from here and it is expected that this deposit will prove an important source for this material.

San Diego, Calif. The first water shipment of feldspar from this port was recently made. This material will be used in the manufacture of plumbing fixtures at Berkeley.

Southern Feldspar Corp. reports its business has been doubled at the Toecane, N. C., plant since the first of the year. Inquiries for ground feldspar have shown a noticeable upturn.

Washington, D. C. Sales of German potash in September showed a decided increase, it is reported. While sales for the entire year are lower than 1931, it is expected that the full year will show very little reduction.

Personals

Walter H. Miller, formerly Kansas salesman for the Dewey Portland Cement Co., is candidate for county assessor in Kansas City, Mo.

Maurice C. Miller, formerly chief structural engineer of Proudfoot, Rawson, Souers and Thomas, Des Moines architectural firm, has joined the sales staff of the Hawkeye Portland Cement Co.

J. S. Trittle, vice-president and general manager of the Westinghouse Electric and Manufacturing Co., was elected president of the National Electrical Manufacturers' Association at a recent meeting of the organization.

C. E. Fitzpatrick has been appointed superintendent of the Western Limestone Products Co. and the Independent Crushed Stone Co. at Weeping Water, Neb. John Crozier, former superintendent, has resigned.

Harry M. Poole, president of the Iowa Limestone Co., the Flint Crushed Gravel Co., the Standard Gravel Co. and coal companies of Des Moines, Ia., has been elected a director of the Pennsylvania-Dixie Cement Corp.

Lee Trainor, chief engineer of the construction division of the National Lime Association, recently addressed a meeting in Columbus, Ohio, on "Brick, Mortar and Leaky Brick Walls." He also addressed a group of dealers in Memphis, Tenn., on "Masonry Mortar."

Dr. Willis Rodney Whitney, organizer and director of the research laboratory of the General Electric Co., retired from that position because of ill health November 1. He is succeeded by Dr. William David Coolidge, senior associate director of the laboratory. Dr. Whitney continues as vice-president in general charge of research.

A. L. Freedlander, vice-president and general manager of the Dayton Rubber Manufacturing Co., has been in South America investigating possibilities and the development of rubber plantation in the Latin American countries. From there he will go to Europe to confer regarding recent developments on the Dayton "cog-belt" drives and other products.

Obituaries

Daniel C. McCurdy, president of the McCurdy Sand Co., Brilliant, Ohio, died October 16.

Fred W. Stroupe, 38, superintendent of the France Stone Co. at Dunkirk, Ohio, died October 21 following an operation for appendicitis.

Patrick W. Leyden, 62, for 35 years foreman of the Kelley Island Lime and Transport Co. in charge of loading boats at Kelley Island dock, died October 26.

Manufacturers

Kron Co., Bridgeport, Conn., announces Glenn E. Weist is now in charge of its engineering.

General Electric Co., Schenectady, N. Y., announces construction of its $4,000,000 power house is progressing rapidly.

American Rolling Mill Co., Middleton, Ohio, announces the Armco symphonic band returned to the air Tuesday night, October 25, for its fall and winter series of programs.

Whitcomb Locomotive Co., Rochelle, Ill., which recently acquired the Milwaukee Locomotive Manufacturing Co. from the Westinghouse Air Brake Co., will conduct sales of Milwaukee locomotives and parts from its Rochelle office.

Lincoln Electric Co. announces its course in practical and theoretical welding, offered cooperatively with John Huntington Polytechnic Institute, Cleveland, Ohio, will be repeated several times during the winter season. It also announces appointment of Fred C. Archer as manager of the Philadelphia district.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

Air Separator. Bulletin explains 1932 model of the Sturtevant air separator. STURTEVANT MILL CO., Boston, Mass.

Scrubbers. Bulletin explains operating principle of conical scrubber for cleaning aggregate. HARDINGE CO., INC., York, Penn.

Wire Rope. Broadside features "Flex-set" wire rope, describing its advantages. BRODERICK AND BASCOM WIRE ROPE CO., St. Louis, Mo.

Motor Pump. Broadside describes Cameron Motorpump showing full details of construction and features of the pump. INGERSOLL-RAND CO., New York, N. Y.

Steel. "Ryerson Journal and Stock List" gives brief history of the company and indexed stock list of the full line of Ryerson products. JOSEPH T. RYERSON AND SON, INC., Chicago, Ill.

Bulk Cement Scale. Bulletins give specifications of Richardson motor driven duo-screw-feed automatic cement scale and describe operation. RICHARDSON SCALE CO., Clifton, N. J.

Drilling Equipment. Loose-leaf catalog contains descriptive sections on tripods and quarry bars, rock drill steel, hose and hose connections, paint spraying equipment, etc. SULLIVAN MACHINERY CO., Chicago, Ill.

Industrial Rubber Goods. Catalog contains engineering information and data on industrial rubber goods including transmission belts, conveying belts and hose capacities. B. F. GOODRICH RUBBER CO., Akron, Ohio.

Wire Cloth. Catalog 32 contains a hundred pages of concise information for users of wire cloth. A glossary of wire cloth terms is included and description of new developments given. NEWARK WIRE CLOTH CO., Newark, N. J.

Power, Industrial and Process Plant Equipment. Condensed catalog contains illustrated descriptions of every principal product of the Babcock and Wilcox Co. New engineering developments are described. BABCOCK AND WILCOX CO., New York, N. Y.

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Rock Products

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Entered as second-class matter, July 2, 1907, at the Chicago, Ill., postoffice under the Act of March 3, 1879.

Contents for November 19, 1932

Departments

(Rock Products is indexed in the "Industrial Arts Index," which can be found in any Public Library)

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